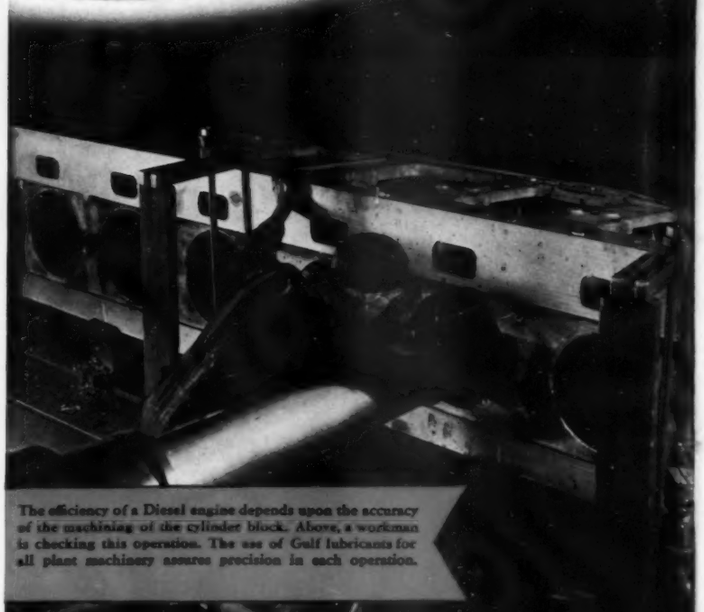
DIESEL PROGRESS

IN INDUSTRY • IN TRANSPORTATION • ON THE SEA • IN THE AIR

MARCH, 1936 CIRCULATION OF THIS ISSUE—IN EXCESS OF 10,000 COPIES 25c

The picture above shows the inspection of pistons and connecting rods after a new engine has been given a test run in the plant of a great Diesel builder. All pistons must set perfectly and ride without wear in their respective cylinders.

PRECISION BUILT DIESELS *demand* QUALITY LUBRICANTS



The efficiency of a Diesel engine depends upon the accuracy of the machining of the cylinder block. Above, a workman is checking this operation. The use of Gulf lubricants for all plant machinery assures precision in each operation.

Gulf supplies a complete line of highest quality oils FOR EVERY TYPE OF DIESEL ENGINE

IN the modern Diesel *engine builder's* plant, precision is vital to each mechanical operation. For, the Diesel builder's one aim is to supply the user with an efficient prime mover—an engine that will run continuously over a long period without appreciable wear or repair expense. That is why leading builders safeguard their costly plant equipment with Gulf quality lubricants and assure precision in each operation.

Of great significance also is the fact that 50 leading builders of Diesel engines in the United States have tested Gulf lubricants and placed their stamp of approval on them. Thus, the *operator* knows in advance that *Gulf supplies the right lubricant* for the particular make of Diesel engine installed in his plant.

Gulf Diesel lubricants have been treated and purified by the finest of the new selective solvent processes. They stand up over long periods of service and insure minimum bearing and cylinder wear.

If you are not using Gulf products, we suggest that you discuss the matter of lubrication with a Gulf representative who will recommend exactly the right type of lubricant for your equipment. This safety measure will assure you of lowest maintenance costs for your Diesels.

Above, a piston is ground for accurate measurement and smooth finish. This grinding wheel takes off only a small cut, and six hours or more are often required to correctly grind one piston.

GULF REFINING COMPANY, PITTSBURGH, PA.

Division Sales Offices: BOSTON · NEW YORK · PHILADELPHIA · ATLANTA
NEW ORLEANS · HOUSTON · PITTSBURGH · LOUISVILLE · TOLEDO

GULF INDUSTRIAL LUBRICATION

Makers of that Good Gulf Gasoline and Gulflube Motor Oil

DIESEL PROGRESS for March, 1936. Volume II, No. 3. DIESEL PROGRESS is published monthly by Diesel Engines, Inc., 2 West Forty-fifth Street, New York, N. Y. Rex W. Wadman, President. Acceptance under the Act of June 5, 1934, at Brooklyn, New York, authorized May 14, 1935. Subscription rates: United States and Pan American countries $3.00, Canada and all other countries $5.00 per year. Single copy price 25 cents in U.S.A., 50 cents for all other countries.

Read the record

7 MAIN BEARINGS

4 1/2" CRANKSHAFT

SMOOTH RUNNING

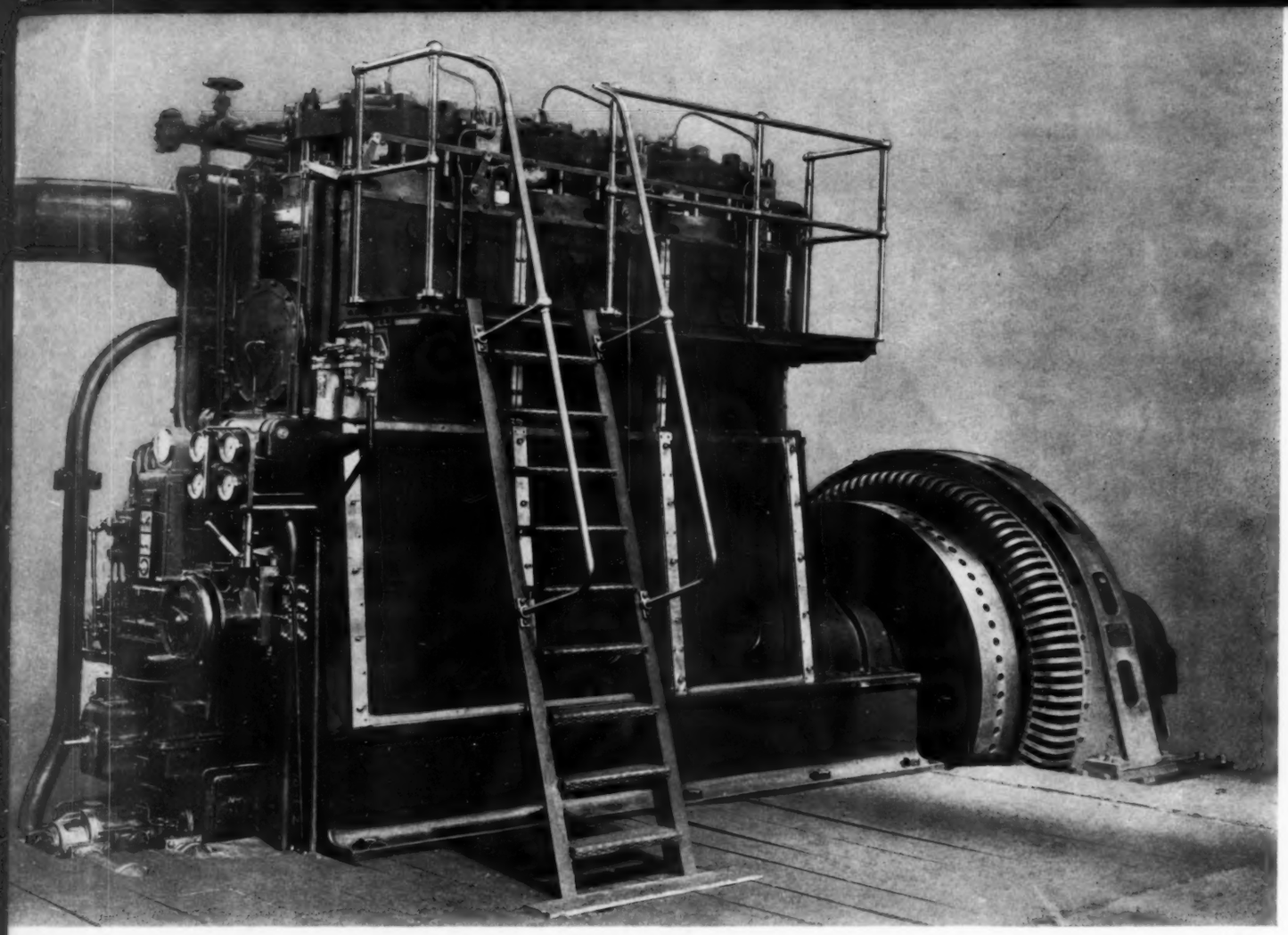
PROVEN DEPENDABILITY

Model HP-602, 85 h. p.

See your nearest Cummins dealer or write direct to Cummins Engine Company, 1101 Wilson Street, Columbus, Indiana.

CUMMINS-DIESELS

INDUSTRIAL
AUTOMOTIVE
AND MARINE



Three single-acting, trunk piston, two-cycle HAMILTON-M.A.N. Diesel engines, 21½" x 27½", 240 rpm. 750 kw. Built by HOOVEN, OWENS, RENTSCHLER CO., Hamilton, Ohio, for the Imperial Irrigation District of California for installation in their Brawley plant.

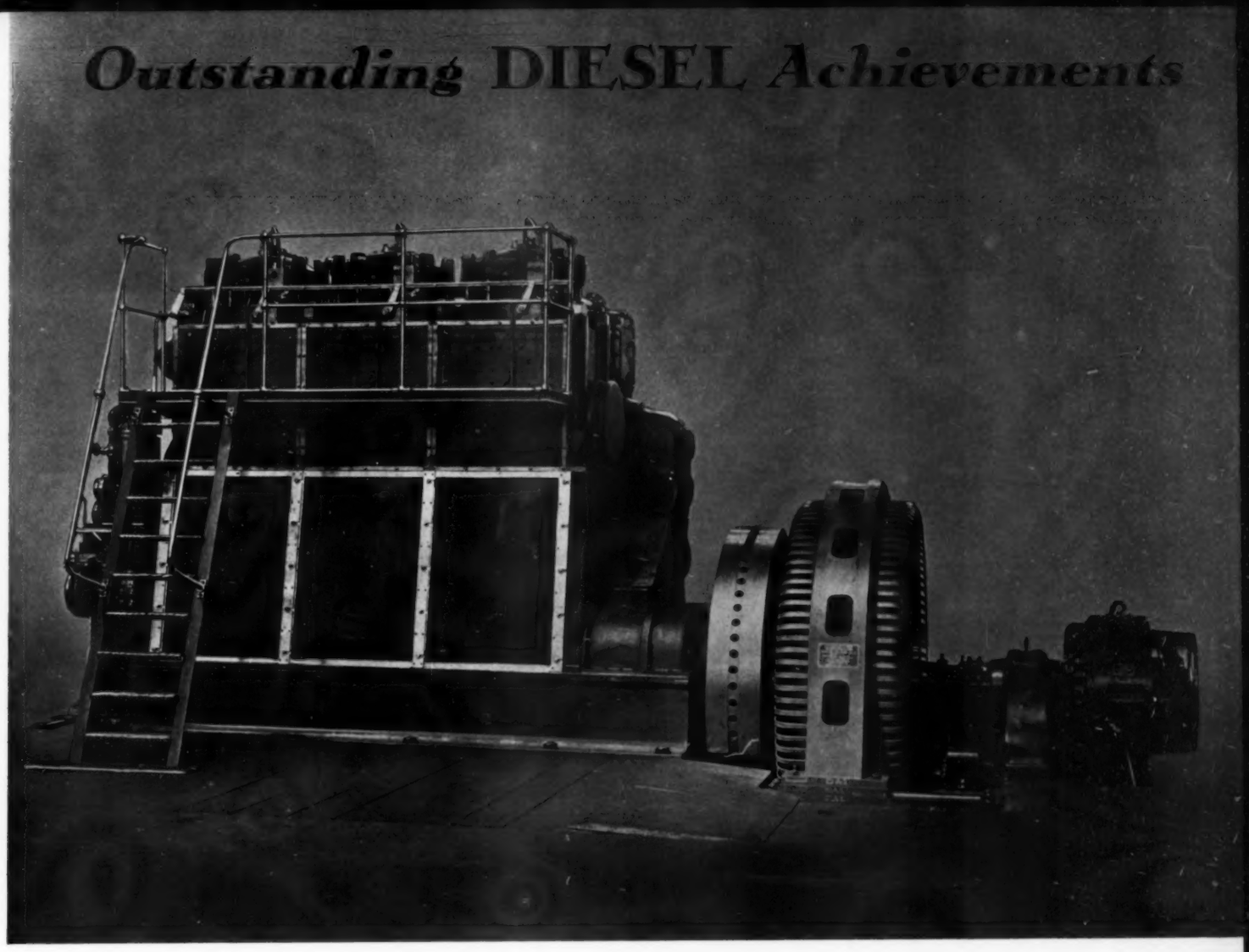
ERIE crankshafts were selected for the three single-acting, trunk piston, two cycle Hamilton-M.A.N. Diesel Engines, built by HOOVEN, OWENS, RENTSCHLER CO., Hamilton, Ohio, for the Imperial Irrigation District of California for installation in their Brawley plant.

When fine quality of material and accurate finish are required leading Diesel Engine Manufacturers rely upon ERIE crankshafts.

Complete facilities for the manufacture of crankshafts, connecting rods, crossheads, generator and extension shafts for all classes of stationary and marine engines. Prompt delivery on all major forged or cast steel elements required in the building and powering of every type of installation.

ERIE FORGE COMPANY, Erie, Pa.

Outstanding DIESEL *Achievements*



ILLUSTRATED above is one of three units recently completed in our plant for the Imperial Irrigation District of California, which is installing them at Brawley. Eventually this Brawley Diesel plant will be a part of the stand-by service when the All-American Canal, now under construction, is electrified.

Consisting of three, single-acting, trunk piston, three-cylinder HAMILTON-M.A.N. Diesels, 21½"x27½", running at 240 rpm. and rated at 750 kw., this new Diesel installation in California will rank with the famed Vernon, California, plant in engineering achievement, in interest and in operating economies.

HAMILTON-M.A.N.

THE HOOVEN, OWENS, RENTSCHLER COMPANY

HAMILTON, OHIO

Division General Machinery Corporation

210 and 280 H. P., 3-cylinder and 4-cylinder Superior Diesels at Sunbury Milk Products, Sunbury, Pa.

Modern power plants everywhere are effecting important economies with Superior Diesels. Municipalities, public buildings, and industrial plants of all sizes need not continue with excessive power cost.

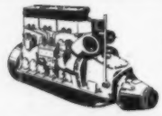
Burdensome power cost can be turned into an item of profit if invested in a Superior Diesel installation.

Superior Diesels meet every requirement of the modern power plant — sturdy — compact — self-contained — reliable — economical.

Heavy duty Diesels from 50 to 900 HP in 3 to 8 cylinders and a wide range of speeds. Smaller Diesels from 25 to 150 HP in 2 to 8 cylinders, bring Diesel power savings to small power user as well as to large.

Refer your power problem to "Superior" Engineers.
Write for Bulletin D-133-P.

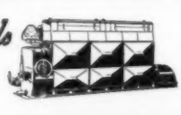
Superior DIESELS



Small Diesels
25 to 150 H. P.

THE
NATIONAL - SUPERIOR
COMPANY
SPRINGFIELD, O. . . . LOS ANGELES, CAL.

Heavy Duty Diesels
50 to 900 H. P.



THE OTTO ENGINE WORKS . . . . PHILADELPHIA, PA.

Diesels in the oil fields, too, develop smooth, steady, economical power with

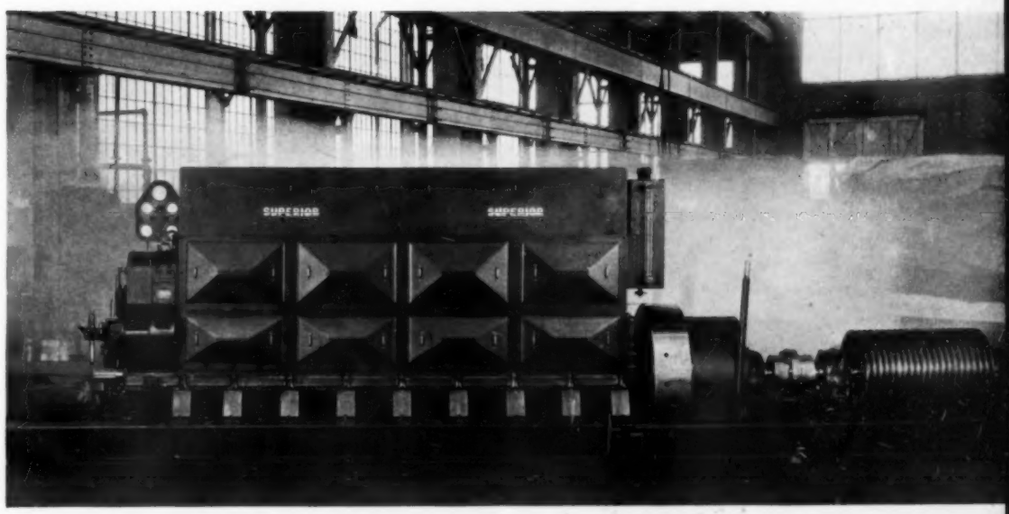
SATCO* LINED BEARINGS

JUST as surely as the Diesel engine is projecting itself into all fields where dependable, economical power is essential, so too, are Satco lined bearings rapidly becoming standard equipment in Diesels designed for all types of work.

Satco lined bearings have long since proved their ability to stand up under heavy loads, difficult operating conditions and extraordinary stresses and strains.

The power plant pictured above uses two 350 hp., 9" x 12", 8 cylinder Diesel engines built by National-Superior Company of Springfield, Ohio, at work operating an electric drilling rig in the Oklahoma City oil fields. The cut at the right shows one of the Diesels in the shop at Springfield.

If you are building or using Diesels, it will pay you to get all the facts about our Satco metal bearings.



*A patented alloy manufactured by National Lead Co. Trade mark registered.

AMERICAN BEARING CORPORATION

AFFILIATED WITH NATIONAL LEAD COMPANY

INDIANAPOLIS — INDIANA

CENTRIFUGAL American Bearings FORCE

DIESEL BUILDERS IMPROVE RESULTS FOR USERS

22 of the 26 Leading Diesel Engine Builders Definitely Recommend or Approve the Use of Gargoyle D.T.E. Oils

THAT'S SIGNIFICANT! It means that with all the Diesel lubricants from which to choose today the majority of Diesel builders agree—"Gargoyle D.T.E. Oils are superior in efficiency and economy."

No matter what make or type of Diesel you have in service Gargoyle D.T.E. Oils give Correct Lubrication from start-up to maximum speed. The dangers of stuck rings, worn liners and scored pistons are minimized. Cleaning periods are less frequent. Fuel consumption is reduced.

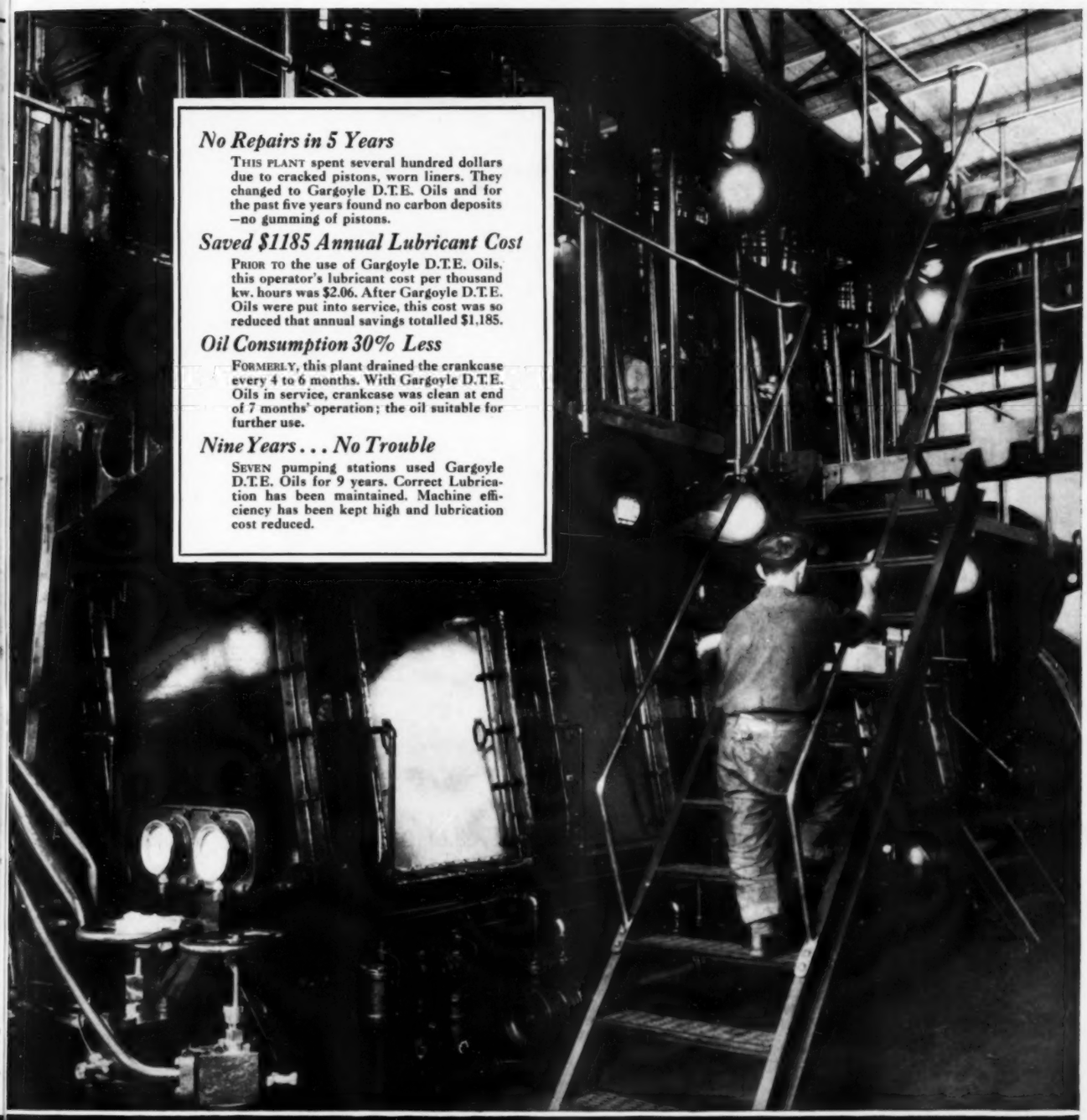
Read the results on the opposite page. These are from users who have compared Gargoyle D.T.E. Oils with other lubricants.

You can expect the same, or better results, depending upon your operating conditions. Make it a point to talk with the Socony-Vacuum representative.

SOCONY-VACUUM

INCORP

STANDARD OIL OF NEW YORK DIVISION · WHITE STAR DIVI-
WADHAMS OIL COMPANY · MAGNOLIA PETROLEUM COMPANY ·



No Repairs in 5 Years

THIS PLANT spent several hundred dollars due to cracked pistons, worn liners. They changed to Gargoyle D.T.E. Oils and for the past five years found no carbon deposits —no gumming of pistons.

Saved $1185 Annual Lubricant Cost

PRIOR TO the use of Gargoyle D.T.E. Oils, this operator's lubricant cost per thousand kw. hours was $2.06. After Gargoyle D.T.E. Oils were put into service, this cost was so reduced that annual savings totalled $1,185.

Oil Consumption 30% Less

FORMERLY, this plant drained the crankcase every 4 to 6 months. With Gargoyle D.T.E. Oils in service, crankcase was clean at end of 7 months' operation; the oil suitable for further use.

Nine Years . . . No Trouble

SEVEN pumping stations used Gargoyle D.T.E. Oils for 9 years. Correct Lubrication has been maintained. Machine efficiency has been kept high and lubrication cost reduced.

M OIL COMPANY

P O R A T E D

DIVI- SION · LUBRITE DIVISION · WHITE EAGLE DIVISION

NY · GENERAL PETROLEUM CORPORATION OF CALIFORNIA

GARGOYLE

Lubricants

CATERPILLAR V-8—160 H.P. EQUIPPED WITH FUEL AND LUBE PUROLATORS.

CATERPILLAR DIESEL SEVENTY-FIVES WITH LE TOURNEAU SCRAPERS AT WORK ON CALERO DAM IN SANTA CLARA COUNTY, CALIFORNIA. D. McDONALD OF SACRAMENTO IS THE CONTRACTOR.

THE DUSTIER THE JOB—*the more your Diesel needs* PUROLATOR

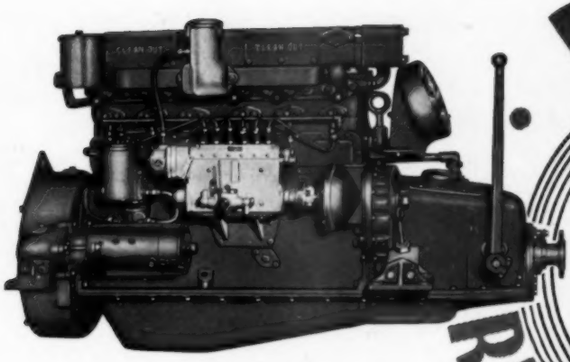
Diesels in the presence of dust require adequate protection against abrasives which cause excessive wear in cylinders, bearings, piston rings and all other working parts.

The Caterpillar Diesel works continuously under the most adverse conditions. With perfectly clean fuel and lubricating oil their dependability is assured. That is why the new 160 horsepower Caterpillar V-8 Diesel is equipped with Purolators for fuel and lubricating oil.

There is a type and size of Purolator to meet every Diesel requirement. Consult us on all problems of oil and fuel filtration. Motor Improvements, Inc., 365 Frelinghuysen Avenue, Newark, N. J.

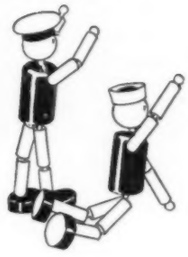
PUROLATOR

THE OIL FILTER



BUDA SILVER CROWN MARINE ENGINES

THE BIGGEST Little 6 Cylinder Diesel on the Market Today



POWER! 70 horsepower all tucked into a compact package less than 6 ft. long. And a full Diesel with all the advantages that any Diesel brings, plus the advantages that only Buda-Lanova "Silver Crown" Marine Diesels can bring.

Buda has brought an answer to the demands of those owners of small cruisers who have been forced to use gasoline because of cramped engine quarters, bringing them Diesel economy and safety.

And if you need more horsepower there is the 6-LDM-415 and the 6-LDM-468, 95 and 110 hp. respectively—also ideal for small cruisers and like the 6-LDM-275 incorporating Buda-Lanova features. Buda-Lanova advantages put boating on a new plane for smoothness and dependability of operation.

6LDM 275

BUDA-LANOVA "Silver Crown" Advantages

- Greater horsepower per pound of engine.
- Soft Combustion — Longer life to reciprocating parts.
- Lower Pressures.
- Lower Combustion Ratios.
- Higher Controlled Turbulence —Better Combustion and a Clean Exhaust.
- Smoother Operation.

Send for Bulletin No. 881 for *complete* details.

THE BUDA COMPANY
Marine Engine Division K
Harvey (CHICAGO SUBURB) Illinois

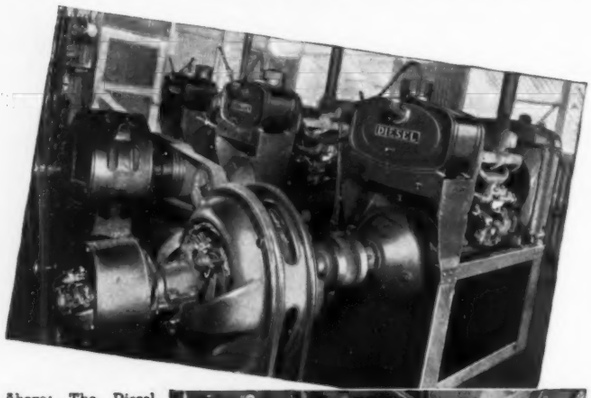
BUDA SILVER CROWN MARINE ENGINES

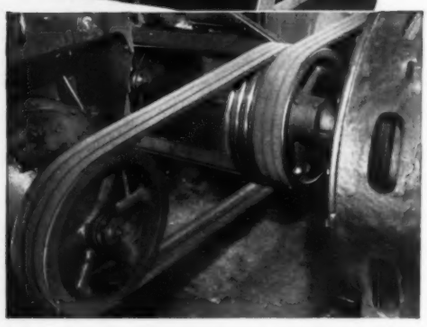
"SINCE installing this plant we have realized a saving of approximately $300 a month. We are well satisfied with its operating efficiency. Such a plant can easily provide power for the operation of many a large resort hotel or for a small community housing an equivalent population."

—W. E. HARRIS,
Vice-President, Peninsular Distributing Corp.

Battery of three International Harvester PD-40 Diesel Power Units driving two generators to provide energy for lights and to pump water for the Sulphur Springs, Florida, resort of the Peninsular Distributing Corporation.

International Harvester Diesel Power Saves $300 a Month for Florida Resort





Above: The Diesel Power Units from the generator side. In the foreground is the 37½-kilowatt generator driven by one Diesel engine through a flexible coupling. In the background is the 75-kilowatt generator operated by two of the Diesels through V-type belts.

At Right: Close-up view showing how the two Diesels are hooked up to the larger generator.

THE three International Harvester Diesel Power Units shown here effect this great saving for the Peninsular Distributing Corporation at its Sulphur Springs, Fla., resort.

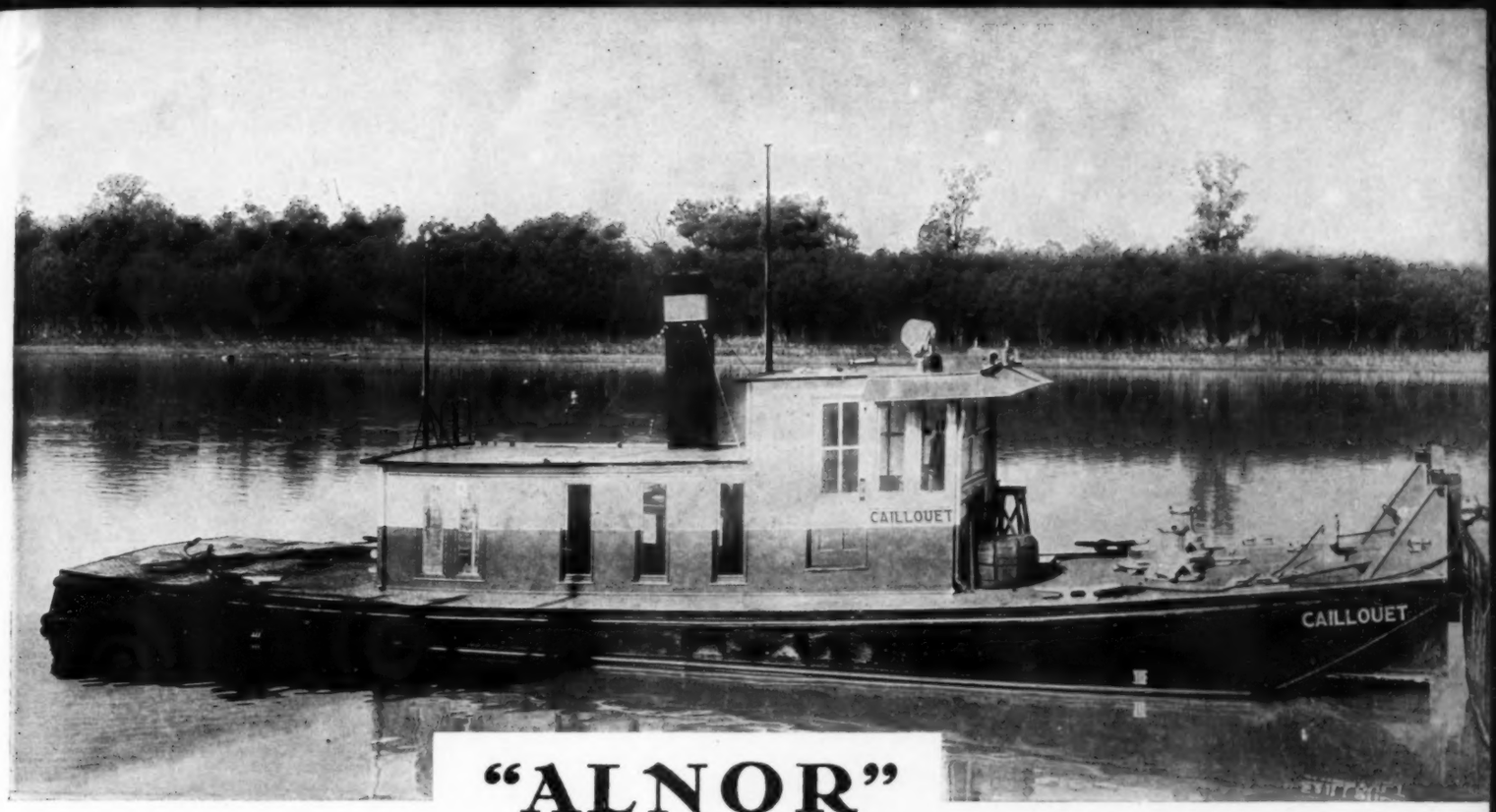
Operating two generators of 75-kilowatt and 37½-kilowatt capacities respectively, these units thus provide power for lighting, operation of motors, etc., in a hotel of 100 rooms and 15 apartments, 8 stores, 2 restaurants, 6 private residences, a gasoline filling station, the swimming pool, and 250 bathhouses. Power is also furnished for a 25 h.p. motor which fills a 200,000-gallon water tank at the top of a 200-foot tower, supplying water under 80 pounds pressure for the entire property. The plant occasionally powers visiting carnivals.

Since the load varies from 6 to 80 kilowatts every 24 hours, the hook-up is such that one engine can be used alone, two together, or all three, and the generators can be run alone or together.

This installation at Sulphur Springs is an example of what can be done with International Harvester Diesel Power, and of the economy it provides compared to other forms of power. For complete information, see our nearest industrial power dealer or Company-owned branch, or write us.

INTERNATIONAL HARVESTER COMPANY
(Incorporated)
606 South Michigan Ave. Chicago, Illinois

INTERNATIONAL HARVESTER



"ALNOR"

Pyrometers for Water and Oil Temperatures Serve These Four U. S. Engineer Boats

IN THE four Diesel powered Dredge Tenders recently built by St. Louis Shipbuilding & Steel Company for the U.S. Engineering Department, an "Alnor" low range 12-point pyrometer is used on each boat to provide temperature readings of the lubricating oil, in and out of each engine, circulating water in and out of each engine and raw water in and out of each of the heat exchangers.

These boats which are named Caillouet, Wailes, Buckridge and Rodney, are each powered by two Fairbanks, Morse, 8-Cylinder, Model 36-A-5-½ engines.

Now "Alnor" pyrometers can be obtained in the same style and design for the lower temperatures of lubricating oil and water as "Alnor" pyrometers for exhaust temperatures. The instruments can be mounted on the switchboard distantly from the engine where all readings can be easily and conveniently taken. The cost of the multi-point pyrometer is generally less than for individual dial type instruments heretofore used.

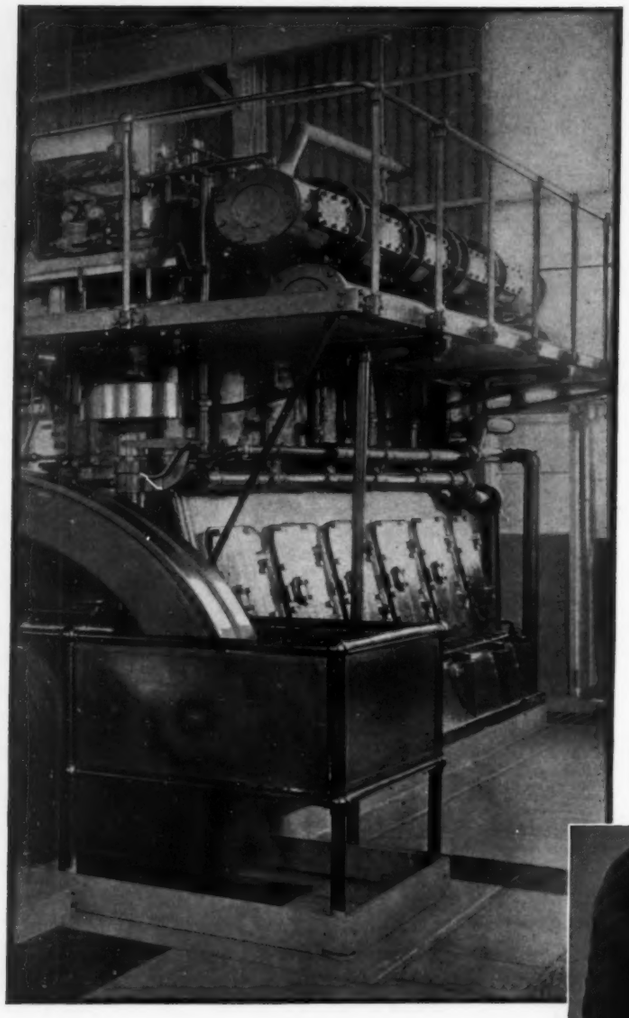
WRITE FOR INFORMATION

ILLINOIS TESTING LABORATORIES, Inc.
423 North LaSalle Street • Chicago, Illinois

Testing Engineers and Manufacturers of "ALNOR" and "PRICE" Pyrometers
The Products of 36 Years' Experience

"Alnor" Pyrometers—*The Engine X-Ray*

The
MOST EXPENSIVE PART
of your Diesel is the part you can save on



Your *fuel* costs per 1,000 horse-power hours can be more expensive than even new liners. To reduce what you pay *by improving what you get,* Texaco refining engineers developed URSA. Today more Diesels are lubricated with URSA than with any other brand. (It sells at regular prices.)

With URSA, it has been found possible often to operate *for years* without taking down the engine for cleaning rings or checking liners.

Stuck rings are* Not *a "necessary evil"

Because URSA was developed with Diesels in mind, the only carbon it may form is soft as flour.

Neither does it form gum to stick your rings.

With *all* rings free in their grooves, the seal is complete and compression remains longer at maximum.

Thus your fuel oil gets no chance to seep down past the compression rings into the crankcase. There is no blow-by, no cylinders out of round.

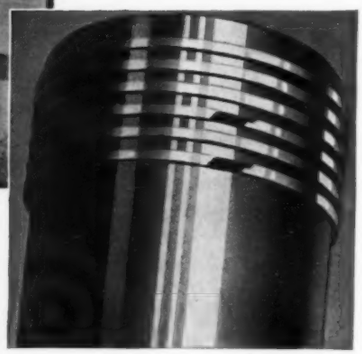
Spontaneous combustion, the principle of the Diesel, requires the full compression which free, clean piston rings alone can give.

Thus URSA, because it saves you fuel and increases efficiency of output, becomes the *cheapest* form of lubricant you can buy. Give the Texaco representative an opportunity to prove the economies of Texaco Ursa.

•

THE TEXAS COMPANY
135 E. 42nd St., New York City

Nation-wide distribution facilities assure prompt delivery.



Here's where the worth of your oil shows up. Stuck rings mean blow-by, loss of power, fuel waste.

TEXACO
REG. T. M.

TEXACO LUBRICANTS *for stationary, marine and automotive Diesels*

FRONT COVER ILLUSTRATION – Three thousand, one hundred and fifty marine Diesel horsepower. The *Point Breeze* tanker in tow by the tugboats *Van Dyke I, II, III* all owned by the Atlantic Refining Company and all powered by Ingersoll-Rand. These four Diesel vessels are in their tenth year of dependable service.

TABLE OF CONTENTS ILLUSTRATION – A Hercules powered Cletrac 80 owned by Hanrahan & Wilcox, San Francisco, on the job of cutting down the historic Nojoqui grade about 30 miles north of Santa Barbara on the famous Coast route. Photograph by Orville Logan Snider.

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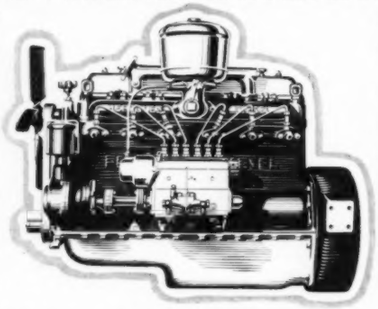
HERCULES

DIESEL ENGINES

PERFORMANCE—The widespread acceptance of Hercules Diesel Engines by manufacturers of powered equipment can be accounted for in one word—*performance*—dependable, economical and highly efficient performance.

One of the reasons that exceptional performance can be expected from Hercules Diesels is the exclusive, patented pre-combustion chamber, located at the side of the cylinder and at the top of the area swept by the piston. An unusually thorough mixture of fuel and air results in complete combustion, which means a smooth, clean-burning, *performing* engine.



Twenty years of experience in heavy-duty engine building lies back of every Hercules model—both gasoline and Diesel—and is at the command of every manufacturer of powered machinery.

HERCULES MOTORS CORPORATION, Canton, Ohio

America's Foremost Engine Manufacturer • Power Plants from 4 to 200 H. P.

DIESEL PROGRESS

REX W. WADMAN, Editor and Publisher

ON the evening of November 20th, 1935, near Dilco, New Mexico, a fire occurred in the engine room of Atchison, Topeka & Santa Fe Railroad Diesel-electric locomotive known as the Super-Chief. News flashes pertaining to this fire appeared in the newspapers throughout the country the next morning. In some cases inaccurate statements appeared at that time as to the cause of the fire.

Several investigations followed and a detailed report was made by the Bureau of Locomotive Inspection of the Interstate Commerce Commission, published under date of December 20th, 1935. In the February 8th, 1936, issue of *Railway Age* appeared an article giving the essential facts of this investigation.

Despite the availability of proven facts, gathered by an unbiased source, there have recently appeared in print, articles and editorials dealing with this fire containing misstatements, containing inferences which were incorrect, because based on misinformation, thereby causing possible damage to the designer and builder of the Super-Chief and likewise damaging to the Diesel industry.

To clear the record and stop further misleading rumors from circulating, to the general damage of the industry as a whole, I am quoting, on pages 47, 49 and 50 of this issue, the report of Mr. John M. Hall, Chief Inspector, Bureau of Locomotive Inspection, Interstate Commerce Commission, covering the fire in the Super-Chief on November 20th, 1935.

I regret the necessity of digging into this matter again. I regret that it was ever mentioned in any magazine other than *Railway Age*, certainly no constructive purpose was served thereby. My one hope is that the actual facts, as given on pages 47, 49 and 50, will clarify the situation for our readers and rectify what damage, to the industry as a whole, may have been done by the misinformation wittingly or unwittingly conveyed.

Rex W. Wadman

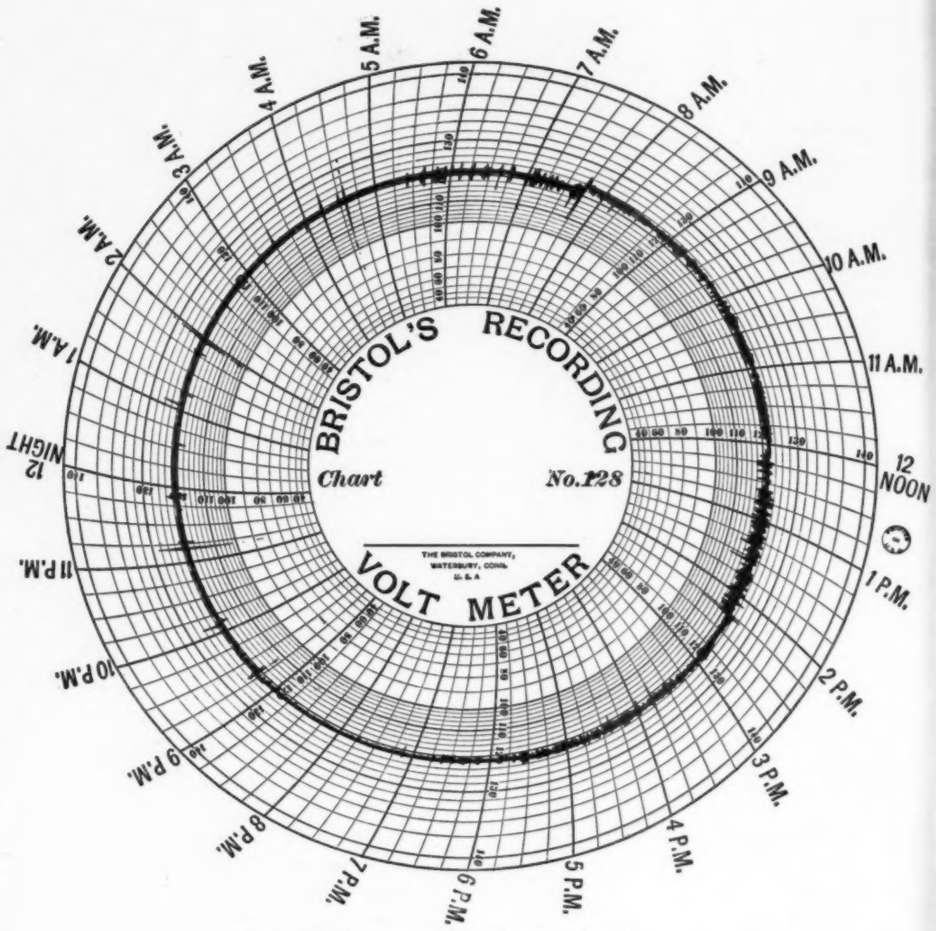
DIESELS IN PARIS

By H. J. ACHEE, PLANT SUPERINTENDENT

PARIS, Kentucky, population 6,250, located in the very heart of the "Bluegrass Country," lies just 80 miles south of Cincinnati and 18 miles north of Lexington, the most famous, historical and beautiful part of the state. One of the most progressively administered cities in this section of the nation, it has only arrived at this distinction after years of determined and aggressive fighting to attain municipal ownership of its utilities.

The water plant and system was secured first (by purchase in 1931) and followed, as soon as practicable, by the complete, outstanding, and modern Diesel Electric generating station and distribution system which was installed in 1933. This combined plant is located in ample, beautifully landscaped grounds at the extreme east end of the city on the immediate bank of the picturesque Stoner Creek, from which the city water supply is drawn.

In 1901 the original direct current electric plant, privately owned and steam operated, was started, with rates about 15 cents per kwh. This was maintained by these citizens until 1910 when it was sold to the St. Louis Power & Development Co. The system was rebuilt, changed to alternating current, and the rates were reduced to 13 cents per kwh. It was then operated continuously until 1920, when sale was effected to the Kentucky Utilities Co., who added a gas engine, made a few changes in the system and reduced the rates to 11 cents per kwh. In 1927 local operation was abandoned by a grouping of several plants to a high line system with rate change to several steps of 10, 8 and 6 cents per kwh.



Typical 24 hour recording voltmeter chart of the Paris, Kentucky, municipal Diesel plant.

In 1929, upon expiration of the franchise, the city officials requested rate reductions from the Utility Co., who submitted a rate structure based upon the "room" gage scheme, 8 cents per kwh., and a long time franchise. As usual, it was found the "new" rates were appreciably higher, so, through the antagonistic attitude of the company, the city officials were, in 1930, constrained to ask the electors for their decision, by an election, whether a municipal

H. J. Achee, General Superintendent, City Electric & Water Departments.

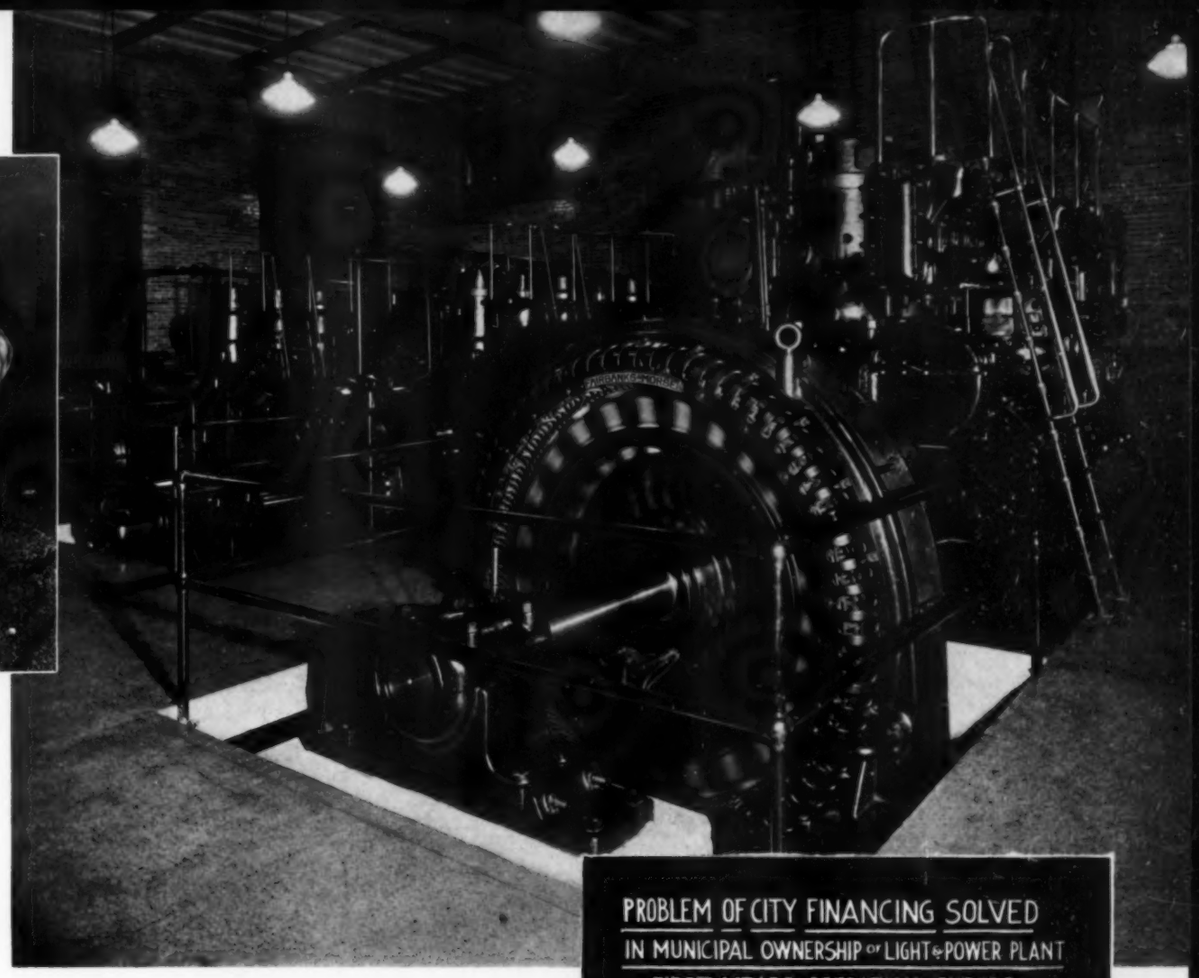


Illustration shows the complete power plant consisting of two 525 hp. Fairbanks, Morse Diesels and one 1050 Fairbanks, Morse Diesel.

PROBLEM OF CITY FINANCING SOLVED
IN MUNICIPAL OWNERSHIP OF LIGHT & POWER PLANT
FIRST YEARS OPERATION CLEARS
$21,000.00
this was accomplished after first effecting a saving in Reduced Rates to Electricity Consumers of more than $25,000.00 annually
TOTAL SAVINGS TO PARIS ELCTRICITY CONSUMERS
FROM REDUCED RATES $25,000.00
PROFITS FROM PLANT $21,000.00
TOTAL ANNUAL SAVINGS $46,000.00
these figures are for the period from Oct. 31, 1933 - Oct. 31, 1934 and the profits from plant, if given 100% Support by the CITIZENS OF PARIS, could be increased another $15,000.00 or more.
ARE YOU HELPING ?

The problem of city financing has been solved in Paris, Ky., according to the evidence displayed in the above sign.

electric plant should or should not be built. This carried favorably by the overwhelming majority of four to one.

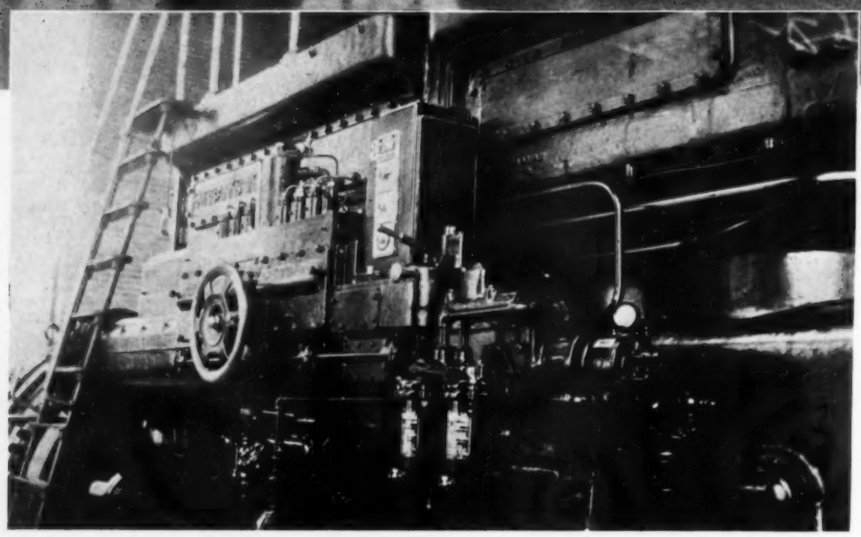
After this decisive mandate on the part of the people, the customary endless number of law suits were initiated, one after another, by the power company. Often it looked hopeless to the city commissioners and city managing agent, but they kept on fighting. With the city solicitor, who won every case, cooperating, and their strong determination and foresight, it was possible to sign a contract with the Fairbanks-Morse Company for the entire plant in 1932. Installation was again further delayed through unavailing court attack by the Utility. It was only in 1933 that work could be commenced and operation of the Diesel plant began in late October.

The entire plant is ultra-modern in every way; building of vitrified face brick, both exterior and interior, with actinic glass in windows; basement, roof with magnesia insulation, 30′ ceiling, terrazzo floor; the Diesel engines and auxiliaries are all fitted out with complete controls and alarm systems, including Alnor pyrometers indicating the exhaust temperatures for all three engines, and the switchboard is complete dead front design. The system of distribution is complete, as evidenced by there being 85 more street lights than when served by the Utility Co., and the Main Street White Way, extending ten blocks, having ornamental 300 watt lamps, on each side of the street every 100 feet or eight to the block, and one on each of the four corners at the street intersections.

The day the contract for the installation was signed the Utility Co. reduced rates to a peak of 7 cents per kwh., graduated on quantity consumption down to 2 cents per kwh., and a water heating, off peak, rate of 1 cent per kwh. These are the lowest rates in the state for cities of like population, and are in effect in but a few cities where the Utility is being evicted. Previously the company had maintained that the old rates would mean service to the city at a loss.

The Utility Co. still continues to serve a small percentage of the consumers and much pressure

The above illustration shows the two 525hp. F-M engines taken before the 1050 hp. F-M engine was installed.



Close up of the operating gear of the 1050 hp. engine showing Nugent fuel oil filters, Woodward governor and F-M fuel pump

has been directed against the city plant.

The city uses exactly the same low rate structure as adopted by the company, and the earnings from the municipal light plant have enabled the commisioners to reduce materially the tax rate and also the occupational licenses, in addition to having made contributions to deserving local institutions.

In late October, 1933, when the municipal electrical plant went into service, the load consisted only of the water pumping plant and street lighting, for both of which the city pays the department. There were no customers; Kentucky Utilities had them all – but not for long.

On January 1, 1934, the city had 900 customers and a profit of $2,837.08 from the plant operation.

On January 1, 1935, the number of customers had grown to 1,164 and the profit for the year, over and above all operating expenses, bond interest, bond retirement, amortization and repair funds, insurance on plant, compensation insurance, contributions, extensions and materials in stock, amounted to $18,193.98.

January 1, 1936, the number of customers has grown to 1,215 and the profit for the year, over and above all out-go and reserves, amounts to $15,587.75.

Putting it another way to show better the growth, the number of customers were:

Late October, 1933 ..... 0%
January 1, 1934 ..... 56%
January 1, 1935 ..... 71%
January 1, 1936 ..... 78%
AND STILL IMPROVING

Ninety-five per cent of the business houses in the city patronize the municipal plant, including the U. S. Post Office, chain stores, large blue grass cleaning plants and other well paying loads. The city has an investment of $230,838.30, none of which can fall on the taxpayers since it all must be paid from earnings and no higher mathematics are required to see that in a very few years the entire plant cost will be paid. Rates can then be further reduced and still enable the city to appear on the much envied, ever growing, "tax free" list of progressive municipalities throughout the nation, a large proportion of whom are able to be so fortunate only through the earnings of their home owned, Diesel powered, utilities.

The future for Paris is bright.

RED RIVER LUMBER

By EVERETT B. KANE

OUT behind the "Diesel House" of the great Red River Lumber Company headquarters at Westwood, California, your visitor early in September found two of the three Atlas Diesel engines that made pioneer Diesel tractor history there in logging pine back in 1928 and 1929. That was three years before manufacturers were offering Diesel powered tractors to the trade.

In a general way, the writer knew that Red River was rated among loggers over the world as progressive and not afraid to do things to solve its problems of harvesting cheaper logs to maintain a margin of profit while paying its men a high wage standard. It was well known that the Walker family, now in its third generation of logging, was rated go-getters among loggers generally. They had brought in tractors for logging as far back as 1924, had introduced logging arches, built up their tractor fleets to more than sixty units that worked in fleets like football teams to increase footage per man and per hour to bring down costs. Also, they were Diesel-minded before many loggers even knew the difference between Diesel and gas power.

But to say that we were surprised to find at Westwood so much Diesel logging and milling history, so many different kinds of installations of so many kinds of Diesels, is putting it mildly. No wonder one of the Diesel salesmen of San Francisco who recalls the demands of Red River for Diesels to meet various problems of power in camp, woods and shop speaks of "Ted" Walker as "Diesel crazy" in those days. Today, his pioneering seems quite sensible and on sound business lines. He knew what Diesels should do and was merely applying Diesel power to his business.

But let Diesel Manager A. Archibald, in charge of Red River Lumber Company's Diesel House, tell the story of the concern's Diesels: "Our first Diesel arrived in September, 1926, and is still on the job, as you saw today. It was a pair of 300 hp. Ingersoll-Rands sent in an American Locomotive with General Electric motors, a combination product of three concerns.

"We went to Germany in 1927 for our second Diesel, a 3-cylinder Colo. It went into a pumping plant, was out of commission for two years

An Atlas Diesel pioneer that made history. First Diesel engine that went into a logging tractor in 1928. Jerry Roberts now working at the Diesel House installing this old veteran in the box car for a camp power and light plant unit. Below the illustration shows one of the seven Allis-Chalmers LO tractors in its daily routine of snaking logs.

This 100-ton Ingersoll-Rand Diesel electric locomotive is starting its tenth year of dependable service hauling logs to the mill.

during the depression, and is again at work furnishing light for Camp 8.

"A Cummins single-cylinder Diesel was the next one added, being but 12 hp., and getting on the job back in 1927. It first furnished light to one of the camps, and is now doing the refrigeration work for the commissary at Camp 8.

"In 1928, Red River pioneered Diesel tractors by taking Caterpillar gasoline Sixty's and changing them over to Diesel power by substituting Atlas Diesel engines for the Cat gasoline engines. We changed over three of those old Sixty's, installing Atlas Imperial Diesels, and every one of these Atlas Diesels is still at work for us today.

"Those were the prosperous days when we could afford to experiment. Quite a little changing and tinkering was done on those first three Diesel tractors, but the engines were O.K. and are now in Bucyrus-Erie shovels that build our logging railroads. One of them was loaned to Heald's school in San Francisco for class work for a while during the slack time. That engine is now being set in a car for a power plant for one of the camps and will again be in action in a few days.

"Those three Atlas Diesels in the 50-B Bucyrus-Erie shovels used in building our railroad right-of-way have all been big successes with us. Of all the 23 Diesels of various makes bought during the past ten years for use on various jobs in Red River Lumber Company operations none has given better satisfaction, nor has any firm exceeded the Atlas Imperial Diesel Company in service and cooperation. Each engine uses about fifty gallons of fuel on a double shift of sixteen hours.

"In 1929, we added two Foos Diesels to the fleet. The first one was of 90 hp. for lighting and was traded in for a 4-cylinder 150 hp. Diesel of the same make for locomotive service, where it worked for four years and then put into service as a light and power plant. Our second Foos was bought in 1931 for the locomotive that you see switching cars out there in the mill yard. It is an 8-cylinder 300 hp. that takes 35 gallons of fuel daily.

"Now as to these tractors, the score today is seven Allis-Chalmers LO Oil tractors, five Caterpillar 50 Diesels, one Caterpillar 75 Diesel, and one old Cat Sixty converted to burn Diesel fuel by one of the local men."

It may interest many of our readers to know just what can be expected of the Diesel and oil engine driven tractors now on the market in connection with logging operation.

A ten day test was run at the Red River Lumber Company last year and accurate records were kept by the lumber company's own men. In this particular instance the records covered the operation of an Allis-Chalmers type "L-O" tractor equipped with a Hesselman type oil engine.

Fuel oil	219 gals.
Trips	149
Time	61½ hrs.
Scale	578,930 Bd. Ft.
Fuel per hr.	3.3 gals.
Footage per trip	3,885
Footage per hour	9,443
Price fuel oil per gallon	.0515

In a further check one day's output was figured and this check was made on January 1, 1935:

Trips	16
Logs	74
Scale	84,850 ft.
Average per log	1,140 ft.
Average per hr.	12,120 ft.
Average per load	5,300 ft.
Average trip time	26.2

. . . . *And now please turn to page 46*

Diesel tender "Caillouet," one of four built by the St. Louis Shipbuilding & Steel Company

TENDER DIESELS

By W. F. REA, JR., U. S. ASSOCIATE ENGINEER

FOUR Diesel boats were recently completed and placed in commission by the U. S. Engineer Department, Vicksburg District. The design, by the Vicksburg Engineer District, represents the application to small boats of the latest approved design of large twin screw shallow draft tow-boats for the Western Rivers, and utilized the latest design medium duty and speed, non-reversing, electric starting Diesel engine.

Names of former District employees who lost their lives in line of duty have been given to two boats, namely, *Caillouet* and *Wailes,* and the names of two landings on the lower Mississippi River to the third and four boats, *Buckridge* and *Rodney.* The St. Louis Shipbuilding & Steel Company, St. Louis, Missouri, built the four boats.

A speed of 10.9 M.P.H. in still water was obtained during the trial runs, with a draft of 2'-10". The principal dimensions are:

Length overall	52'-6"
Beam molded	14'-0"
Width of bottom	13'-0"
Depth molded	4'-6"
Displacement (approx.)	38 tons

The boats offer a very trim appearance with a black hull and gray deck. The lower half of the cabin is gray, while the upper half is white. A small streamlined stack, painted black, houses the two mufflers, and these, together with the two flagstaffs, lend completeness to the boats, and give them a very presentable appearance. The flush deck, 30" wide, with safety treads along each side of the cabin, provides a safe walkway, and ample space for handling lines and equipment.

The steel hull is constructed of riveted and welded design, in accordance with the requirements of the American Bureau of Shipping. The design includes a flat bottom with square bilges, and with three transverse water tight bulkheads. Steel fenders are provided on sides and stern, of split pipe, welded to plates, to protect the boats in landing and when moored alongside other boats or barges.

The bow is equipped with two steel towing knees fitted with wooden fenders, and two hand capstans on the forward deck to facilitate making up tows. The after end of the hull is full tunnel design with two tunnels of square cross section. A double bitt is located on the after deck, for use in towing from a line.

The entire main deck outside of the cabin, is provided with a safety tread by electric welding a raised design, after the hull was assembled. In way of cabin, the main deck is cut away, with the pilot house floor raised 12" above the main deck, and with the engine room floor depressed to the level of the main engine foundations. The entire interior of the hull is accessible for inspection and cleaning, thus insuring continuous protection.

The cabin is constructed of steel, with wood windows and doors. The pilot house, 9'-2" x 6'-0" long, is located over the forward end of the engine room. Windows on all sides afford clear vision for the pilot in all directions. Aft of the engine room is an enclosure 9'-2" x 6'0" long for quarters containing one double deck metal bed and one lavatory. The toilet is in a separate small enclosure. Water is supplied by hand pumps attached to the fittings. The quarters are screened, and provided with sufficient electric illumination from the 32 volt batteries.

A part of the steel roof structure over the engines is tack-welded and bolted, so that it may be easily removed, when it becomes necessary to remove an engine. The engine room floor is a diamond pattern, safety tread, steel plate floor, and is removable. Safety tread steel steps from the engine room floor lead to the pilot house at the forward end, and to the

quarters at the after end. Other steps also lead from the quarters to the outside.

The boats are powered with two Fairbanks Morse 8 cylinder, 5½" x 7½", four stroke cycle, solid injection, non-reversing Diesels, developing 100 hp. each at 800 rpm. The 8 cylinder medium speed units reduce vibration decidedly, compared to the heavy duty low speed engines. The cylinders are equipped with removable liners and all water and lubricating oil pumps are attached to the main engines. Each engine is fitted with a closed cooling water system, that is, the circulation water from the engine passes around the tubes in the heat exchangers, and which in turn is cooled by river water running through the tubes. Heat exchangers are also provided for the engine lubricating oil and clutch oil pumps. In this way, river water does not enter the engine jackets, depositing silt and scale. In order to maintain efficient lubrication, the engine lubricating oil is continually circulated through a screen type filter tank. Chase copper tubing with soldered fittings is used for all piping. Exhaust manifolds are water cooled and exhaust mufflers are mounted in stack.

An Alnor pyrometer for low temperature readings is provided, supplying readings for either engine, of lubricating oil in and out of engine, circulating water in and out of engine, and cooling water in and out of heat exchangers.

Fuel is carried in two 250 gallon cylindrical tanks, located in the hull forward of engine room. Lubricating oil is stored in one 50 gallon tank in hull aft of quarters.

The engines are started by electricity, supplied by 32 volt Exide storage batteries. Battery charges are maintained by electric generators attached to the main engines. The clutch is of the wet plate type, with forward and reverse clutches, with a 1 = 1 ratio forward and reverse. and having individual lubrication. They were manufactured by the Twin Disc Clutch Company. For service as dredge tenders on the Mississippi River, this feature of transmitting 100 per cent of engine revolutions to drive shaft when in reverse position, for long periods without heating, is very desirable. The clutches are hydraulically operated, requiring a minimum of time and physical effort on the part of the pilot.

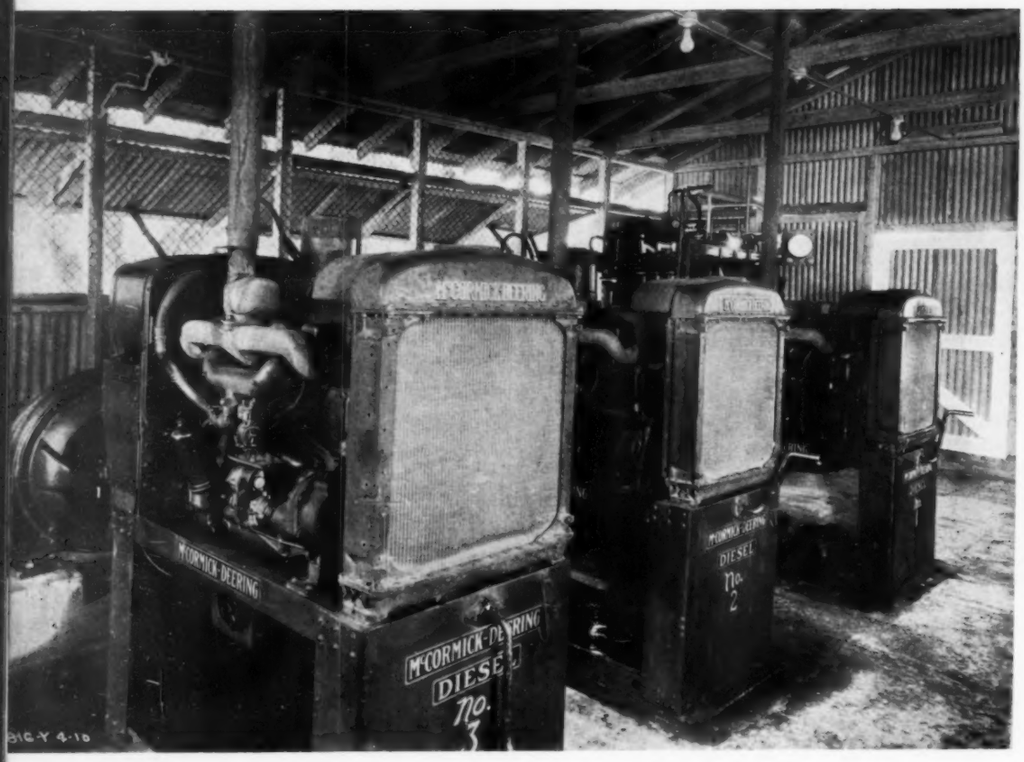
The steel drive shafts are supported by ring-oiled, babbitted, steady bearings and bronze bushings in stern tube and strut. The outboard part of the drive shaft is protected by an extra heavy steel pipe, securely attached to the stern tube and strut and arranged so that grease may be forced through it and to the Vulcan Iron Works strut bearing. The three blade, bronze propellers, 35" diameter by 17" pitch, turn inboard. The propellers may be readily inspected through hatches, in the main deck, and in top of tunnel. Two rudders, one in each tunnel aft of the wheel, have total movements of 80 degrees each.

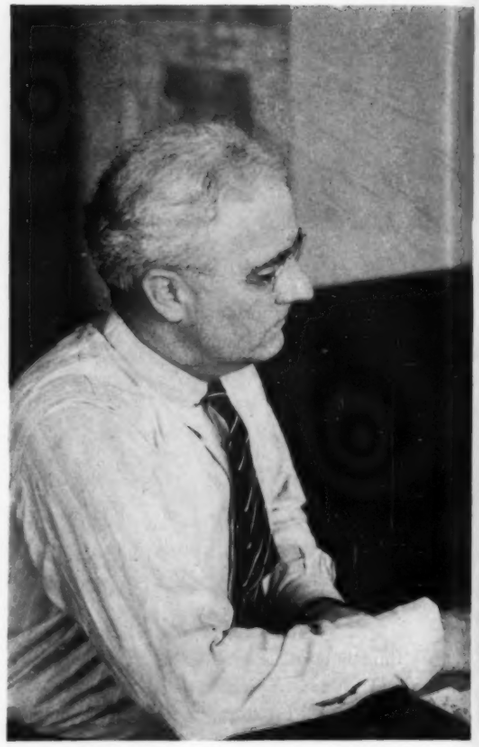
In the pilot house, dual Kimball controls are mounted on a stand immediately aft of the 4 ft. steering wheel. The stand also contains Stewart - Warner tachometers; pressure gauges and starting switches, so that the pilot may stop, start and control all operations pertaining to the running and navigating of the boat, from one position in the pilothouse.

Electric light outlets are provided inside the cabinet, and for navigating lights. One electric searchlight is mounted on the roof of the pilothouse. Electric current is obtained from the Exide 32 volt engine starting batteries.

Two bilge pumps are installed. One Wesco pump, driven by a 32 volt electric motor, is in forward end of engine room, and piped through a manifold to each hull compartment. A hand operated bilge pump is also provided.

The engine room is provided with fire protection by a CO_2 system, using two 50 lb. cylinders, and which is piped throughout the engine spaces.





DIESEL POWER EFFECTS BIG SAVING FOR FLORIDA RESORT

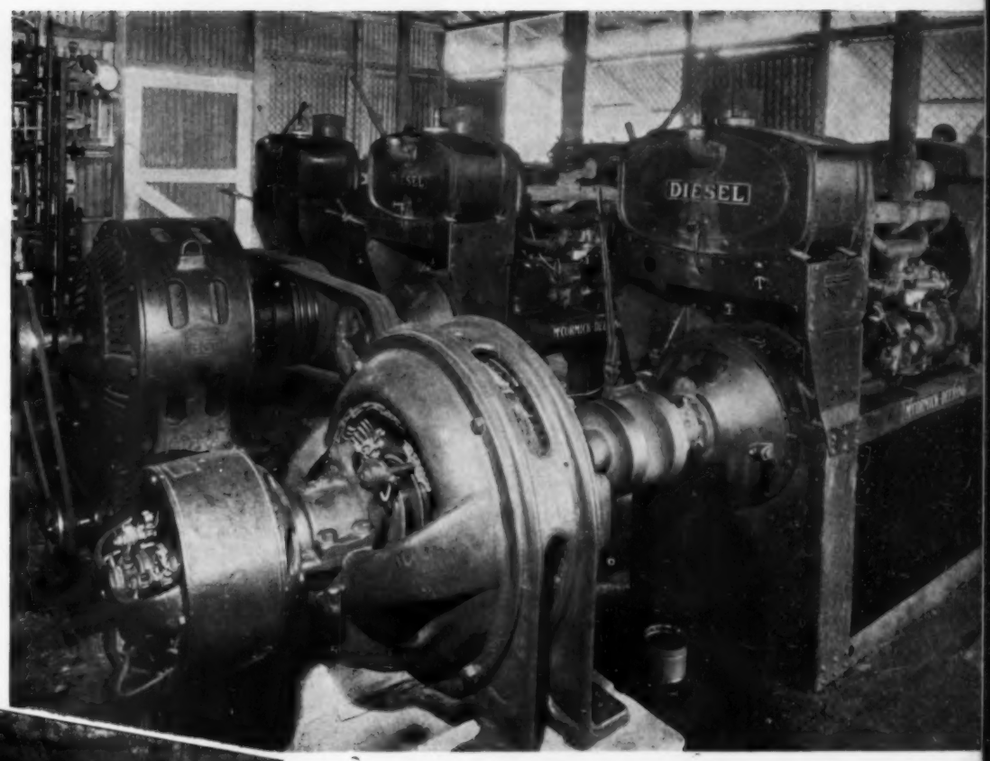
AMONG interesting and efficient small-community lighting and power projects utilizing McCormick-Deering Diesel power is the one operated by the Peninsular Distributing Corp. at its Sulphur Springs, Fla., resort development. Here three McCormick-Deering power units are employed with two generators, one of 75 kw. capacity and the other a 37½ kw. unit. This installation, hooked up as will be described later, provides power for lighting, operation of motors, etc., for a hotel consisting of 100 rooms and 15 apartments which have, in addition to lights, electric stoves, refrigerators, and water heaters; also 8 stores; 2 restaurants; 6 private residences; 16 other refrigerators; and a gasoline filling station. Power is also supplied for a 25 hp. motor which fills a 200,000-gallon water tank at the top of a 200-foot tower that supplies water under 80 pounds pressure for the entire property as well as for motors totaling 8 hp. used for various other purposes. Another use of power from this plant is for lighting the spring-fed swimming pool and 250 bath houses. Occasionally the plant is also called upon to supply power for a visiting carnival.

Two of the McCormick-Deering power units are connected to a large 75 kw. generator shown in one of the accompanying illustrations. Three V-type belts connect each of two power units and the generator, while the third power unit is connected by a flexible coupling with a smaller generator. Both generators have damper windings and are synchronized when operating at full capacity. It therefore is possible to operate either generator independently or both together. Thus, any one of the Diesel power units may be operated alone or any two of them together when the capacity of all three is not required, as either of the two engines on the big generator may be stopped for servicing or when not needed.

The load on the plant varies from 6 to 80 kilowatts, with the maximum load between the beginning of darkness and bedtime running around 70 to 80 kilowatts. In the wintertime the peak is at about 8:00 o'clock in the evening, from which time until 10:00 the load is fairly steady, requiring the operation of both generators. From 10:00 o'clock until shortly after midnight the requirements are easily met by two power units and the larger generator, while from then until about 5:00 o'clock in the morning one engine and the smaller generator, with a load only from 20 to 30 kilowatts, is required. As before stated, this plant has at various times supplied power and light for an occasional carnival with an additional load of approximately 35 kilowatts.

According to J. B. Flanagan, electrical engineer who developed this installation in cooperation with power specialists of the Orange State Motor Co., this plant working 24 hours a day requires only a minimum of attention and has provided satisfactory and economical service for more than two years that it has been in operation.

Above — W. E. Harris, vice-president and general manager of the Peninsular Distributing Corp., and left G. T. Raper, secretary and treasurer.



McCormick-Deering units at Sulphur Springs, Fla.

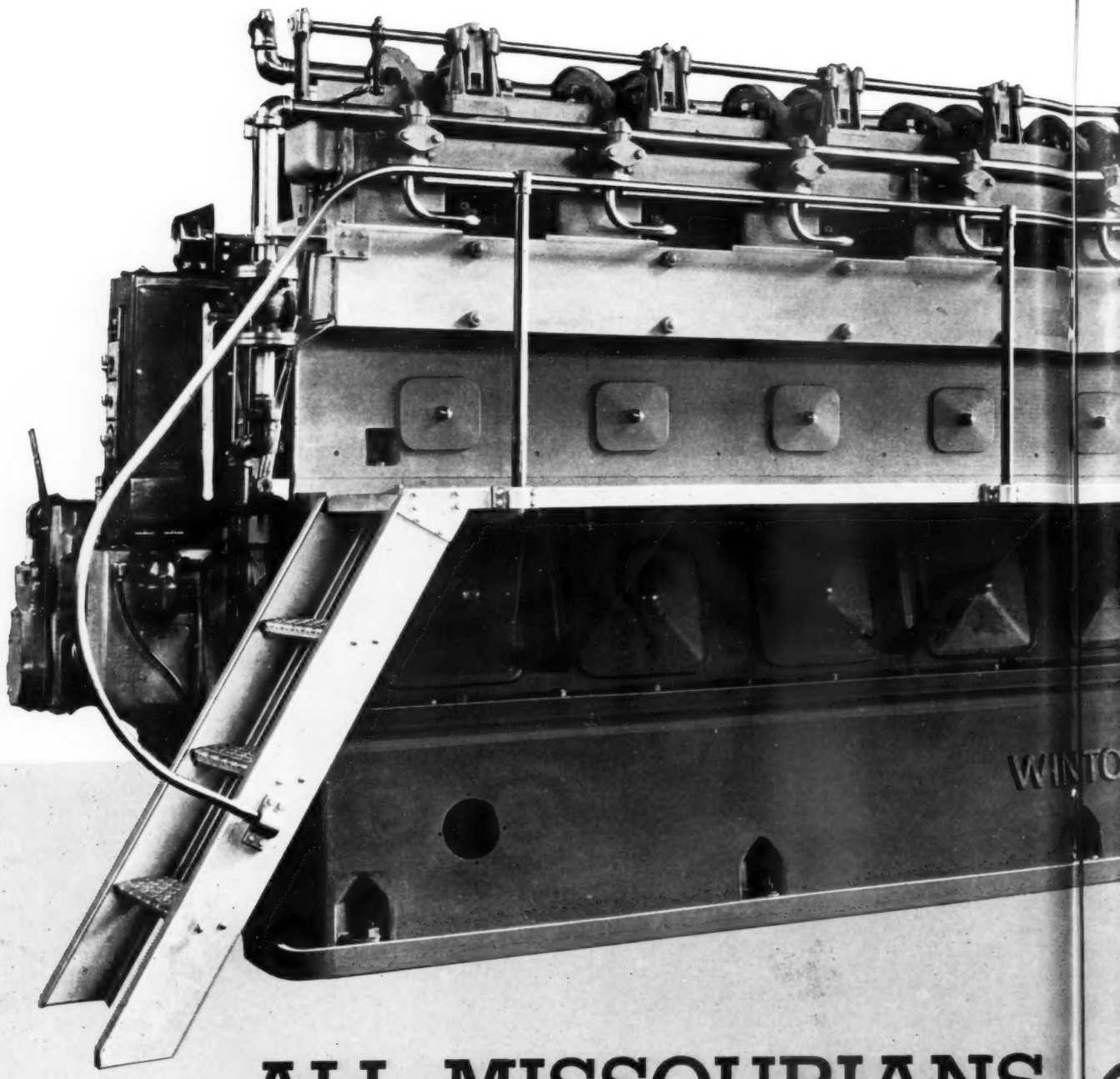
Controls, switches, gauges, etc., in the power plant.

The fuel pumps of the McCormick-Deering Diesel power units are connected to a 1,000-gallon-capacity fuel tank provided with an overflow device all of which require no attention. These engines operate at 1,200 rpm. under constant load; tests made at various times show that the fuel consumption is within the limits estimated at the time the installation was made.

W. E. Harris, Peninsular Distributing Corp., vice-president, recently said, "Since installing this plant we have realized a saving of approximately $300 a month. We are well satisfied with its operation from the efficiency as well as the economy point of view. Such a plant can easily provide power for the operation of many a large resort hotel or for use by a small community housing an equivalent population."

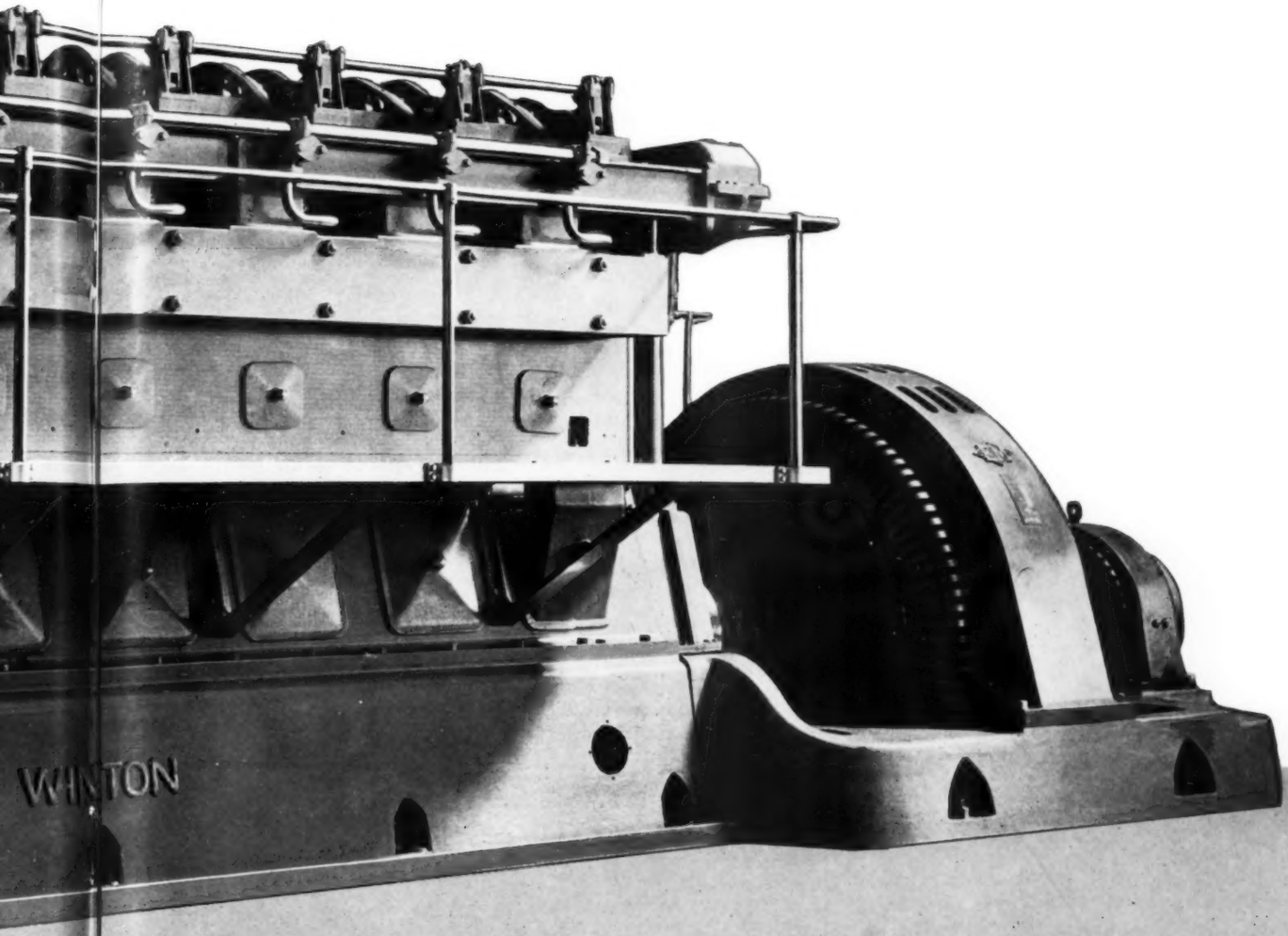
The power units and the generators have been installed in a specially constructed building located at some distance from the hotel. This building has a reinforced concrete floor, with side walls and roof of corrugated-metal covered framework. All four sides are provided with large screened openings as shown in the accompanying illustrations which insure complete ventilation at all times.

. . . . *And now please turn to page 42*



ALL MISSOURIANS

Symbol of Economy
and Dependability



S don't live in Missouri

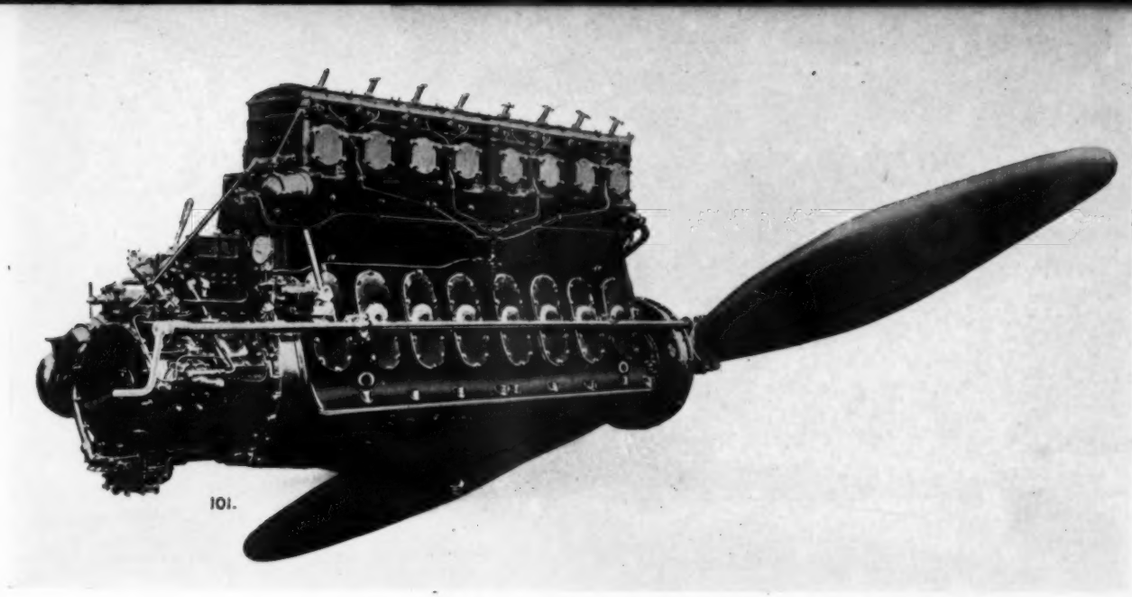
. . . in other words, when it comes to making decisions on new power installations, those who govern the purchases become "men from Missouri" no matter where they live. They have to be shown . . . statements have to be proved . . . performance must take the place of persuasion. This condition was particularly true at the Ludlow Manufacturing and Sales Company of Edge Moor, Delaware, where a recognized firm of consulting engineers was retained to investigate the Diesel engine field. A new plant was under construction. Manufacturing processes called for rigid power control, in combination with factors of Economy and trouble-free Performance. Exhaustive investigation resulted in the selection of Winton-Diesel engines. The new power plant, now being installed, consists of three eight-cylinder Winton-Diesel engines each developing 1000 h.p. at 225 r.p.m., direct-connected to 700 k.w., 600-volt, three-phase, sixty-cycle alternators, with direct-connected exciters; and one four-cylinder Winton-Diesel engine developing 165 h.p. at 400 r.p.m. direct-connected to a 600-volt generator. Again Winton meets the demands of industry with unmatched Diesel facilities and engineering experience keen enough to satisfy the most exacting needs.

WINTON ENGINE CORPORATION, CLEVELAND, OHIO, U.S.A.

Experimental Diesel Making Great Record: Guess who's building this new 6-cylinder automotive Diesel engine that has been installed in a bus making two 2,000-mile round trips weekly between El Paso, Texas, and Los Angeles. Here it is at the end of 28,000 miles. "About 93 gallons of 27 plus Diesel fuel is burned on each 1,000-mile stretch between cities," says the shop foreman. Watch for announcement a little later when one of the great automotive engine builders will be ready to announce its Diesel

A DIESEL BUS—A DIESEL TANK TRUCK

Diesels on the road to Arizona with tankers filled with gasoline from Southern California oil fields and refineries: Three such outfits were seen following each other along this stretch near Banning, Calif., on January 2, 1936, as the cameraman passed them here. By the time he unlimbered his camera and got set, however, they had strung out so that they could not be caught in one shot. This is Pacific Freight Lines' Cummins-motored Sterling, one of some 75 Diesel-powered trucks owned and operated by this firm from Los Angeles headquarters to points north, east and south at a net saving over gasoline-powered trucks of 2.527 cents a mile, according to Vice-president Anthony before the American Petroleum Institute recently.



Beardmore "Tornado," 585 bhp., as used on H.M. airship R-101

LONDON LETTER NO. 4

By GEORGE LIND

EDITOR'S NOTE

In this London Letter No. 4 Mr. Lind comments on the aviation situation in Europe as he sees it being affected by Diesel engines. In some instances he duplicates material we have run in previous issues, but we believe our readers will be interested in his strictly European viewpoint. Our regular aviation correspondent, Mr. Paul H. Wilkinson, picks up the thread of the story where Mr. Lind leaves off.

OF all recent developments of the Diesel engine none has caused so much argument and dissension as its debut into the world of aircraft.

In Great Britain we saw the advent of the aero Diesel already in 1926, but it was not until two years later that a really successful engine was produced. This was a vee-type 12-cylinder Rolls Royce "Condor" petrol engine of 500 bhp. converted to run on fuel oil. At 1,900 rpm. it developed 480 hp. with a power to weight ratio of less than 3 lbs. per bhp., and at cruising speed it consumed .423 lbs. of fuel per bhp. hour.

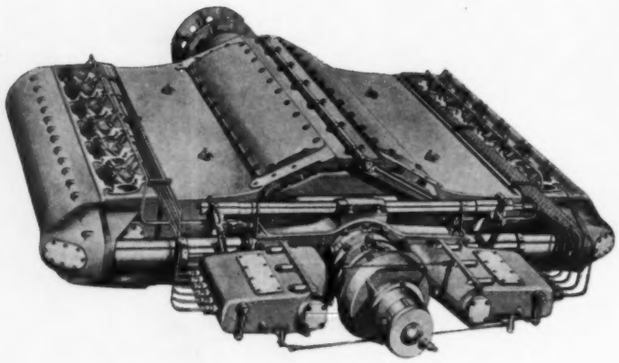
Between 1928 and 1930 another British firm was also busily engaged on experimental aircraft engines, this time for the ill-fated airship *R-101*. The firm was Beardmore and their engine was the 8-cylinder 585 hp. "Tornado," which is illustrated above. On her trial flight the *R-101* had five of these motors fitted, giving a total tractive force of 2,925 bhp. Each unit weighed 4,600 lbs., complete with starting gear, and the fuel consumption was only .38 lbs. per bhp. hour.

Since these days, Beardmore has quietly continued with their experimental work and they are now developing what is obviously an extremely fine design for the larger types of power unit. This engine, which is illustrated herewith, is of the horizontally-opposed class, developing 500 bhp. at 1,750 rpm., having 12 cylinders of 6" bore by 6½" stroke, and a weight of 2.8 lbs. per bhp. unsupercharged or 2.3 lbs. per bhp. supercharged. The basic idea is to mount the engine within the wing structure of the aeroplane, as shown in the cut-away diagram, thus reducing frontal resistance and substructure to an absolute minimum.

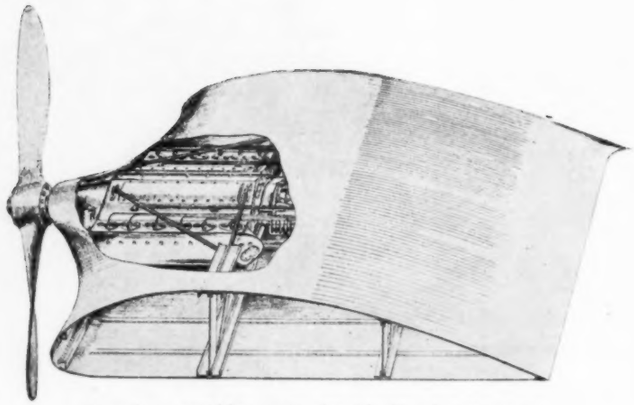
The present position, not only in England but on the Continent as well, is in many ways a difficult one as far as aero Diesels are concerned. One school of thought, basing its arguments on the assumption that aircraft will tend to become larger and larger, says that the only practical power units for planes of the future will be oil engines of between 1,000 and 2,000 hp. The opposition, on the other hand, maintain that the day of such aerial monsters is still far off and that meanwhile for engines of 250 to 750 hp., the gasoline unit remains supreme. Neither of these arguments is particularly helpful so far as the present is concerned, and as a result the aero Diesel's rate of development is being maintained at a steady crawl.

However, despite the ostrich-like tactics of the majority of European aircraft firms, the number of successful aero Diesels on the market has actually risen from six to ten during the past twelve months, all the engines, strangely enough, belonging to the 250 to 750 hp. class.

First and foremost among the ten, come the highly unconventional German Junkers motors. These units are built in sizes of from 400 to 800 hp., the 12 cylinders being vertically op-



Beardmore opposed-type engine, 500 bhp.



Beardmore 500 bhp. engine fitted inside wing structure.

posed and fitted with two pistons per bore. The two-stroke cycle is used in conjunction with a blower, and the two crankshafts are interconnected by a train of helical gears. In Great Britain, Napier is building two similar engines under license, the smaller of the two, the 540 hp. "Cutlass," having a crankshaft speed of 2,100 rpm. and a weight of less than 2 lbs. per bhp.

On the Continent, several passenger and freight planes have been fitted with Junkers engines and in every instance they are working reliably and well. The most recent adaptation is in the new Dornier flying boats designed to carry the South American mail across the Atlantic. For these machines, two "Jumo" 5 engines of 540 hp. are used. They are housed in a nacelle in the center of the wing span, one driving a tractor and the other a pusher air screw. The cruising range of this type of boat is 2,770 miles, and the maximum speed is about 156 mph.

In France a different class of engine is being developed under the aegis of the French Air Ministry. This is the 14-cylinder 500 hp. Clerget. So far some very satisfactory results have been obtained, and three units are now undergoing Air Ministry tests.

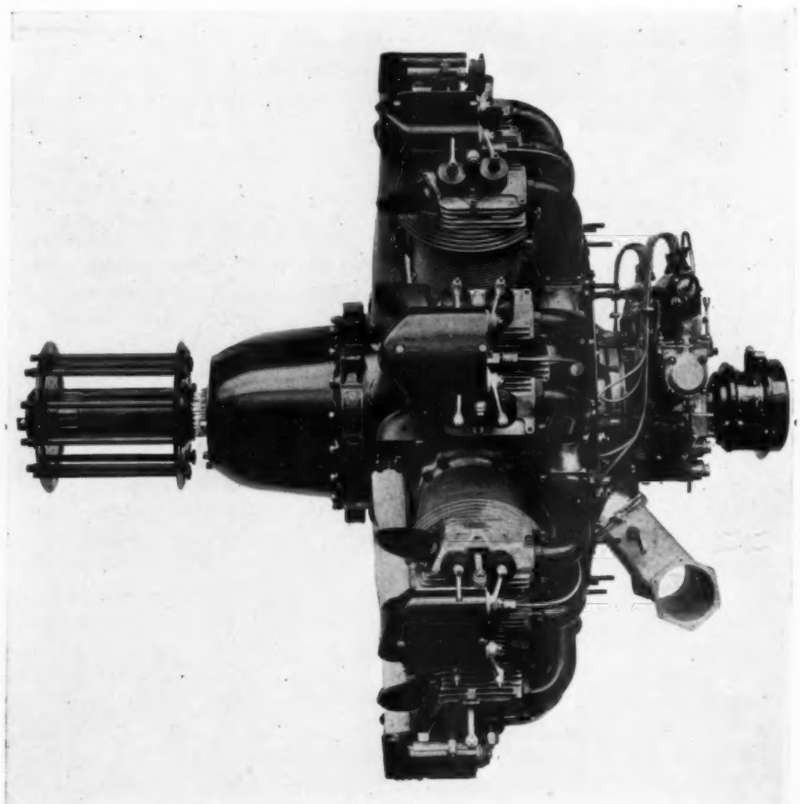
In contrast to the Junkers engines, the Clerget is air-cooled, the cylinders being arranged in double-star form with two banks of seven cylinders each. It runs normally at 1,850 rpm. and has a fuel consumption at that speed of .365 lbs. per bhp. hour. The weight to power ratio is creditably low at 2.64 lbs. per bhp.

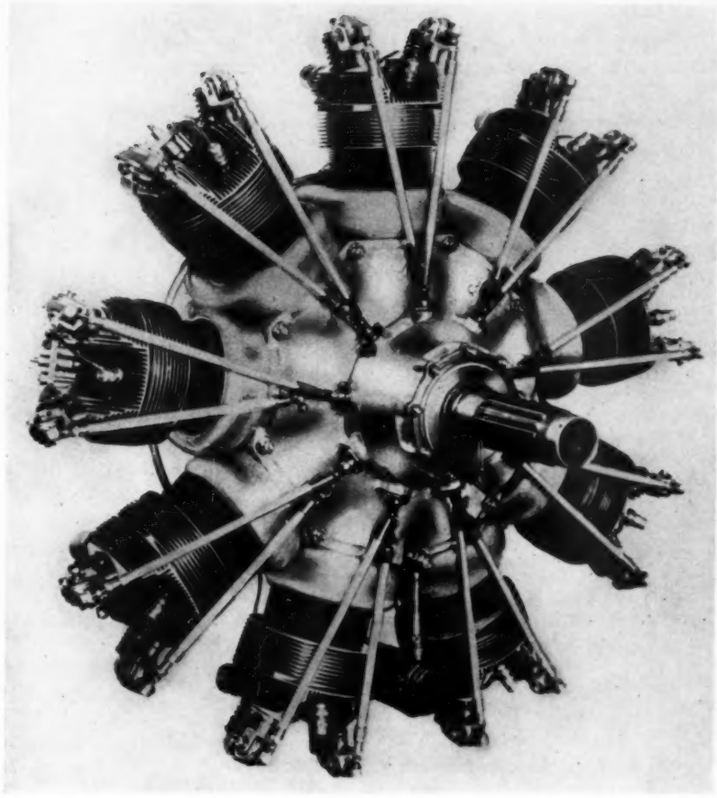
For some time Clerget experimented with this engine at his own expense, but about a year ago the French Air Ministry took the matter up and now all the work is being paid for by them. The French Air Ministry, incidentally, are one of the few bodies showing any live interest in the development of aero Diesels.

A less highly perfected but somewhat similar engine is that produced by the Czechoslovakian National Arms Factory. Known as the Ceskoslovenska Zbrojovka, this aero Diesel employs a novel two-stroke combustion system. The nine air-cooled cylinders are mounted radially, and air under a moderate supercharge is forced by means of a large capacity centrifugal blower into annular chambers at the juncture between the bores and the crankcase. From there it enters the cylinders through a series of tangentially directed ports. After combustion, the exhuast gases are forced out through two ports in the cylinder head, controlled by two overhead poppet valves and interconnected push rods.

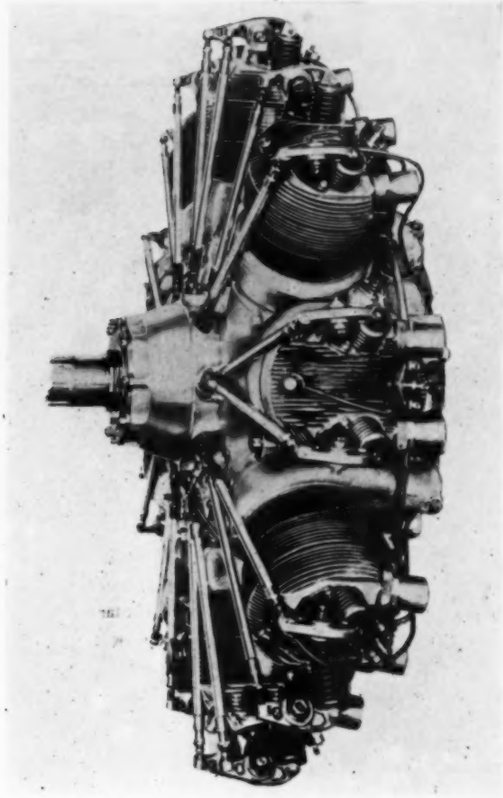
Unusual as this design appears, it has, nevertheless, proved very effective. During bench

Side view of Bristol "Phoenix," 415 bhp.





Front view of Ceskoslovenska Zbrojovka 260 bhp. engine.



Side view of Ceskoslovenska Zbrojovka 260 bhp. engine.

tests carried out with the engine running on .89 specific gravity fuel and a compression ratio of 15 to 1, an absolutely smokeless exhaust was obtained at speeds from 500 to 1,560 rpm., which speaks well for the combustion system. The maximum output and weight to power ratio registered during the same tests were 260 hp. and 2.42 lbs. per bhp. respectively. Front and side views of this engine are shown.

Perhaps the most outstanding performance of any aero Diesel engine stands to the credit of the Bristol "Phoenix," for on May 11th, 1934, a Westland "Wapiti" general purpose plane fitted with one of these engines attained a height of 27,453 feet, a world's record altitude for a Diesel-engined aircraft.

The power unit was a 9-cylinder, air-cooled radial engine of 5¾" bore and 7½" stroke. It had a crankshaft speed of 2,000 rpm. and developed a maximum of 470 bhp. Complete, it weighed 1,090 lbs.

For the past three years the Bristol Company have been working for the Air Ministry on the "Phoenix" engine, its first public appearance being made in the parade and fly-past of the new and experimental types at the 1933 Royal Air Force Display. Since that time a number of modifications have been made and the perfected engine is now only awaiting sufficient orders to put it into production. A side view of the "Phoenix" is shown in the illustration.

From the tests that were carried out in the air with the "Phoenix"-engined "Wapiti," two particularly interesting points emerge. First, that compared with the standard Bristol "Jupiter" VIII petrol engine of slightly higher rated power, the maximum speed at 15,000 ft. is increased by 5 mph. and the climb time to that height improved by 13 percent. Second, that for flights of more than three hours' duration, the fuel consumption is improved by 35 percent over the petrol engine.

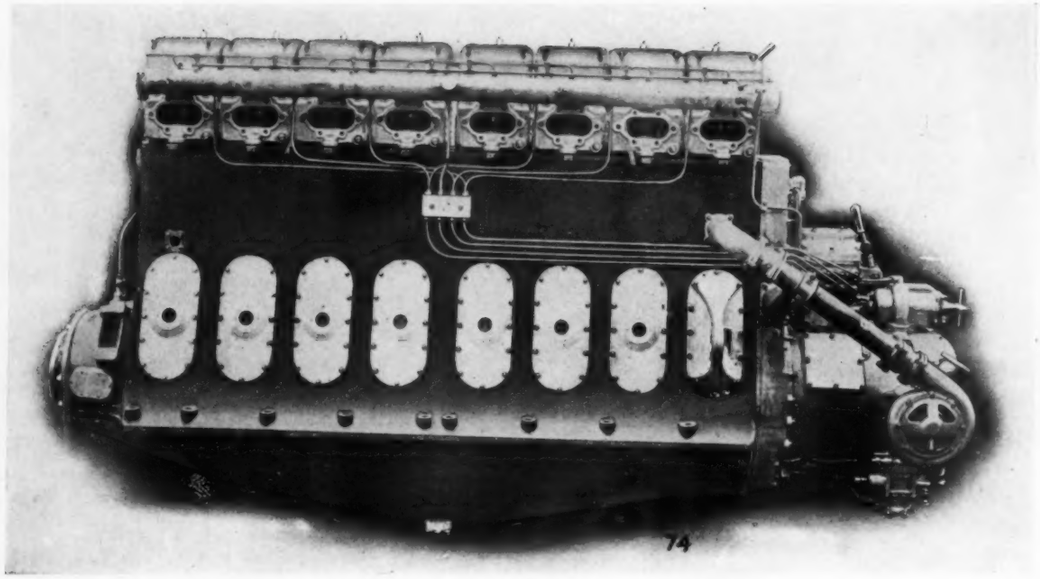
To sum up then, the future of the Diesel for use in aircraft depends on the intensity of development. Up to the present, a few progressively minded companies have spent time and money on bringing the basic designs to life. It now remains for others to join in and carry on the good work.

To quote the old adage—Rome was not built in a day. In Europe, at least, a promising start has been made and a greater reward awaits those who carry the Diesel engine to its future supremacy in the air.

Additional Comments on European Diesel Aircraft Engines

By PAUL H. WILKINSON

IT has been most interesting to read the British viewpoint on the European Diesel aircraft engine industry as presented by Mr. George Lind in his "London Letter" in this issue of DIESEL PROGRESS. One of the most important engine developments to which he refers in his article, is the 500 hp. Beardmore horizontally-opposed engine, which is of a par-



Beardmore "Tornado" 8-cylinder airship engine, 585 hp. at 900 rpm.

ticularly advanced type. As the illustration in his article shows, this engine has great possibilities for mounting in the wing of an airplane – in fact, two such engines could be mounted in tandem if necessary, driving tractor and pusher propellers. It is hoped that the Beardmore will soon reappear in a more powerful form and demonstrate its capabilities for large commercial and military aircraft.

The Clerget engine, which operates on the four-cycle principle, is probably the most advanced of any of the Diesel aircraft engines in France. The smaller, nine-cylinder model, known as the Clerget 9-C, has been in the experimental stage since 1930. It has a bore and stroke of 5.12 ins. and 6.69 ins. respectively, and a displacement of 1,239 cu.ins. Its rated power is 300 hp. at 1,800 rpm., and it weighs 734 lbs., or 2.45 lbs. per hp. A front view of this engine is shown in the illustration.

The larger Clerget engine, known as the 14 F-2 model, is now receiving the active attention of the French Air Ministry. It is of the 14 cylinder, two-row, air-cooled radial type, with a bore and stroke of 5.51 ins. and 6.30 ins. respectively, giving it a displacement of 2,105 cu.ins. In its unsupercharged form it weighs 1,323 lbs., or 2.20 lbs. per hp., based on a rated power of 600 hp. at 1,950 rpm. Fuel consumption is understood to be 0.37 lbs. per hp.hr.

Both of these engines were also produced in experimental form by Hispano-Suiza. When manufactured by this company, they were known as the Hispano-Suiza 9-T and 14-U models respectively, and they were credited with approximately the same power output and weight as the models previously mentioned.

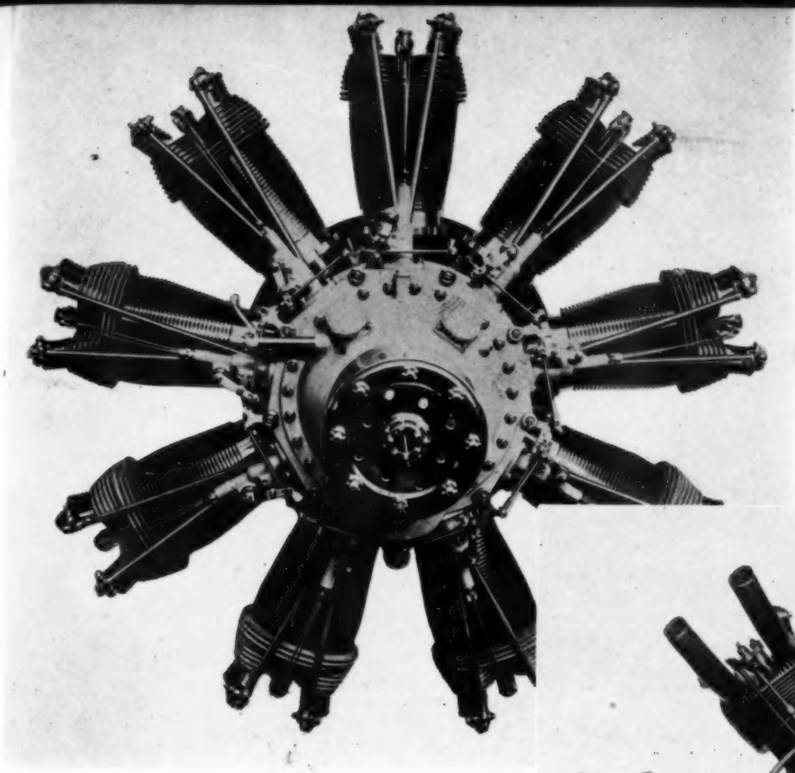
The fuel injection system used on these engines comprises an individual Clerget pump and two Clerget injectors for each cylinder. For starting purposes, a Viet air compressor mounted on the engine supplies air under pressure to the rear row of cylinders.

The Clerget 14 F-2 has already undergone very satisfactory flight tests at an altitude of nearly 20,000 ft. in a Potez 25 airplane, and it is expected that it will make its debut in the aeronautical world this year in the competition for the 10,000,000 francs prize offered by the French Air Ministry for a successful Diesel aircraft engine.

Another aircraft engine of considerable promise, as mentioned in Mr. Lind's article, is the ZOD 260-B, manufactured by Ceskoslovenska Zbrojovka A.S. in Czechoslovakia. Rated at 260 hp. at 1,560 rpm., this new two-cycle engine weighs 633 lbs., or 2.43 per hp. Its bore and stroke are 4.72 ins. and 5.12 ins. respectively, making the displacement 807 cu.ins. Bosch equipment is used for the fuel injection system, and a centrifugal type supercharger driven at ten times crankshaft speed supplies air for scavenging and power boosting. It is equipped with a Viet compressed air starter, the arrangement of which is shown in the rear view illustration.

This engine completed its official 50-hour test in 1933, and has been successfully flown in small military aircraft. It is probable that a larger engine will be produced in the near future based on the designs of the present engine.

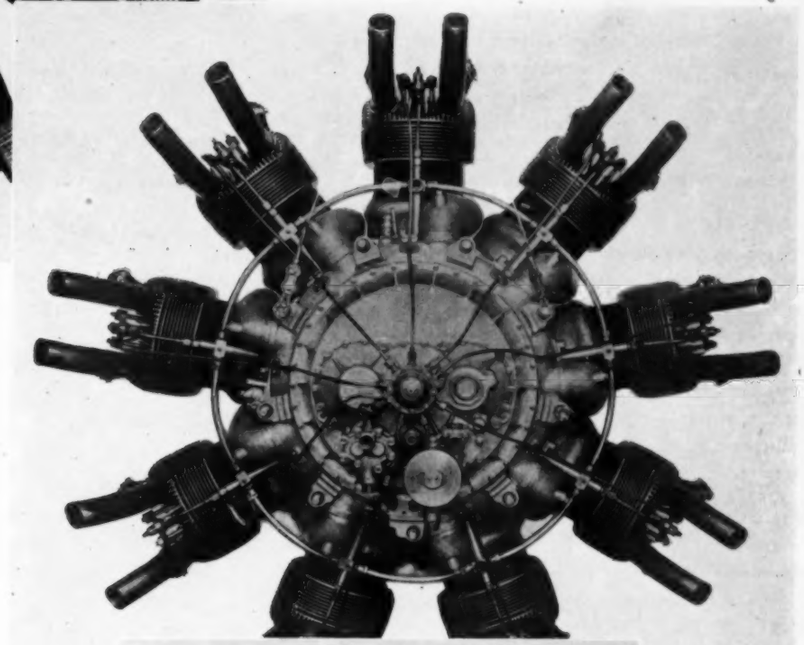
Comparatively little information is available regarding the status of the Diesel aircraft engine in Italy, particularly as a strict censorship is in force there at the present time. However, Fiat probably has some interesting developments under way as they have been working on this type of engine since 1930. An early engine, the Fiat A.N.1, was converted from the Fiat A-25 gasoline engine. It is a four-cycle, six-cylinder, in-line, water-cooled engine, which was rated at 180 hp. at 1,500 rpm. The bore and stroke were 5.51 ins. and 7.09 respectively, giving it a displacement of 1,015 cu.ins. It weighed 884 lbs., equivalent to 4.91 lbs. per hp. Two Bosch fuel pumps, mounted on the rear of the engine, were used to supply fuel to the injectors.

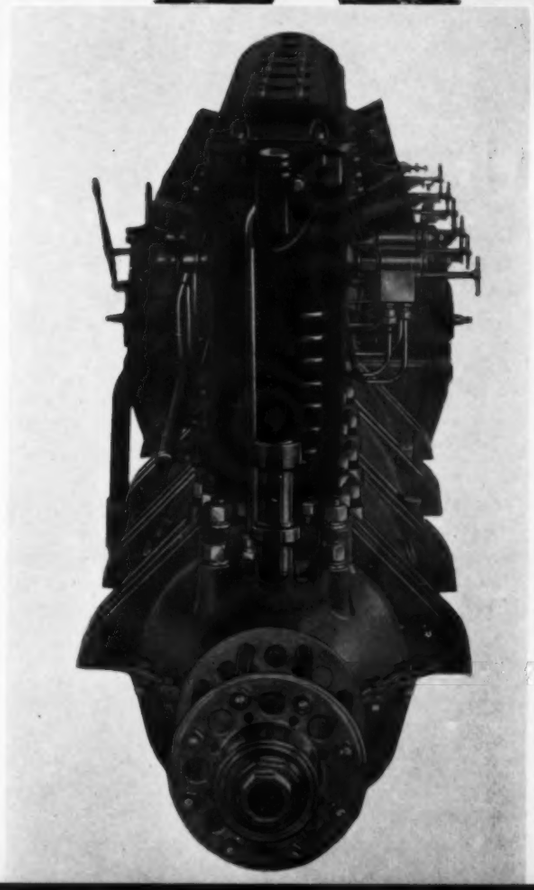


Front view of Clerget 9-C engine, 300 hp. at 1,800 rpm.

Rear view of ZOD 260-B engine, 260 hp. at 1,560 rpm.

Front view of Fiat A.N.1 in-line engine, 180 hp. at 1,500 rpm.





As we go to press information reaches us that G. R. Sharpley, Managing Director, and T. P. N. Burness, Works Manager of Ruston & Hornsby, Ltd., have recently returned to England having spent several weeks in the United States during which time arrangements with the Hercules Motors Corp. were negotiated and completed whereby Ruston & Hornsby, Ltd., will build in England under a new license arrangement the Hercules line of light-weight, high-speed compression ignition engines (Diesels) employing the Hercules patented combustion system and following closely the general design of the well known Hercules Diesel engines.

Preparations are being pushed with all available means and it is estimated that Ruston & Hornsby, Ltd., will be in production on at least one model in approximately four months, and the other models will follow. Until such time as the British built engines are available Ruston & Hornsby, Ltd., are marketing the American built Hercules Diesel engines. The British built product will be known as the "Ruston-Hercules" type.

Ruston & Hornsby, Ltd., have for many years been engaged in the manufacture of heavy-duty Diesel engines and occupy the outstanding position in the British oil engine industry, being the largest producer of oil engines in the British Empire.

MODERNIZED BY DIESEL

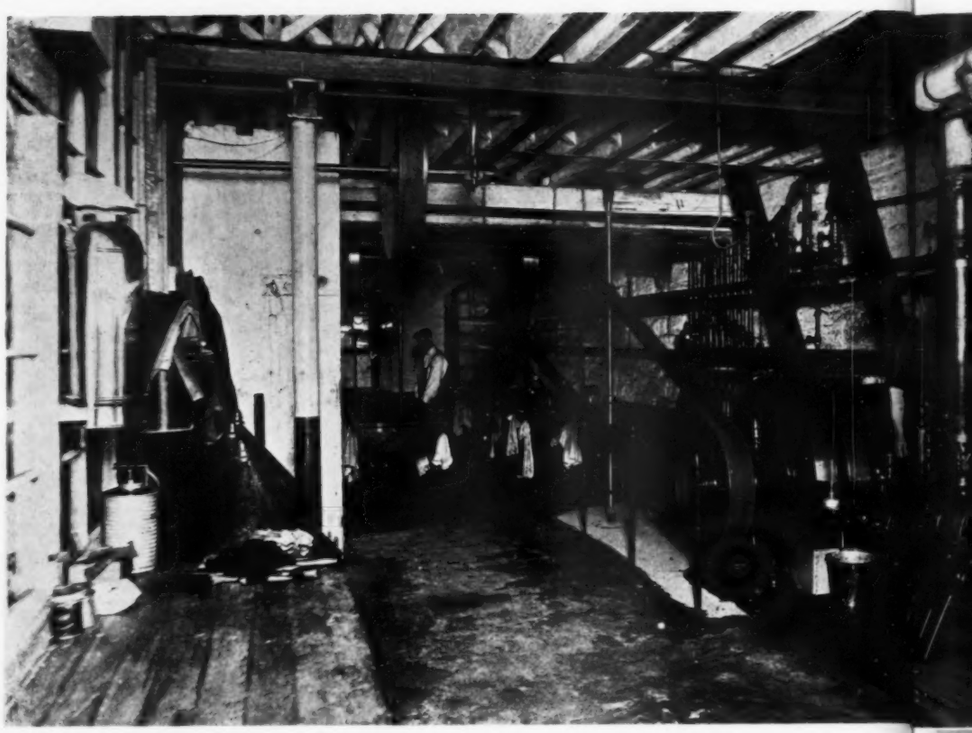
THE John Royle & Sons machine works at Paterson, New Jersey, founded in 1860 before the Civil War, is one of those firms not content to merely look back on its existence all those years. It believes in looking ahead as well. Last March the company celebrated its Diamond Jubilee by installing a thoroughly modern Diesel power plant.

For the past forty years it had been generating its current with an old Corliss steam engine. The boilers were of the vertical porcupine type. This steam plant operated a slow-speed Sprague electric generator having a capacity of 75 kw. at 275 rpm. Ruling that the boilers were over-age, the state steam boiler inspection department told the plant owners that they must be replaced if the company intended to keep on using its steam plant.

In tune with the times, John Royle & Sons began investigating Diesels and found that Diesels would cost less to install and operate than a new steam plant and that it could produce current at a rate substantially lower than they could purchase it from the local power company, according to the power company's quotation.

They purchased the Diesel and found that it came up to their expectations in every way. When its energy is completely harnessed later in the season, the waste heat from the engine will be used to assist in heating the plant in addition to furnishing direct current to the several score of electric motors used throughout the plant to operate lathes and metal working machinery.

The power plant consists of a five cylinder, 9½" x 10½" McIntosh & Seymour Diesel engine developing 150 hp. at 514 rpm. It is totally enclosed and has a force feed lubricating system, and is direct connected to a 100 kw. Crocker-Wheeler direct current generator. Officials of the company state that it generates between ten and eleven kwrs. per gallon of fuel consumed. It operates on an average of 45 hours a week. The load at present, however, is but fifty per cent of the actual capacity of the engine and generator unit. A large reserve is available for future demand. The engine is protected with an Alnor pyrometer, mounted in a wall receptacle.



It took a lot of oil and belt dressing to keep this machinery running smoothly. Here is a view of the Royle plant's engine room when it was fairly new in 1897.

An interesting feature of the installation is the recovery of the waste heat units which will bring the thermal efficiency of the installation up to 83 per cent when the Paracoil waste heat boiler is connected up with the engines and the heat from the exhaust gases are utilized, together with the radiator savings as described.

The engine cooling system is of the closed circulation type, a radiator and a power-driven fan taking air from outside, replaces the customary cooling tower. The fan is reversible with double ducts and is damper controlled, so that air can be taken from outside the building and exhausted back outside, taken from outside and re-circulated inside the building, taken from inside and re-circulated inside, or taken from inside the building and exhausted outside. In this way the cooling water will be used to heat the building in winter, and in summer the power driven fan used to ventilate the building. The engine is also connected with a city water connection in case of failure of the circulating water cooling system.

One of the problems at the Royle plant in connection with the installation was to maintain constant steam pressure regardless of the engine load and exhaust temperatures. This was

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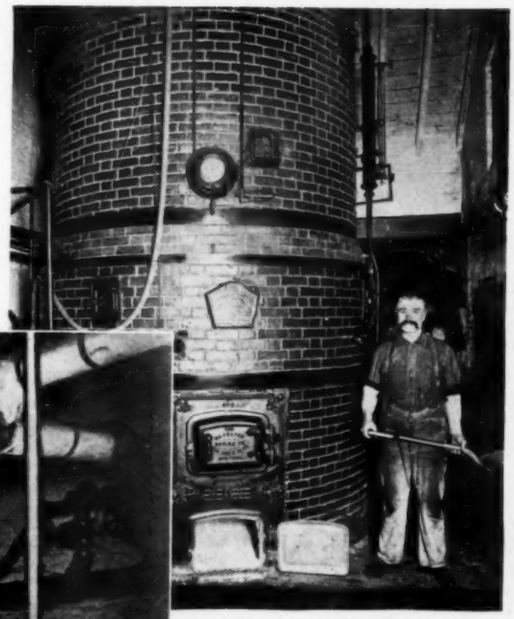
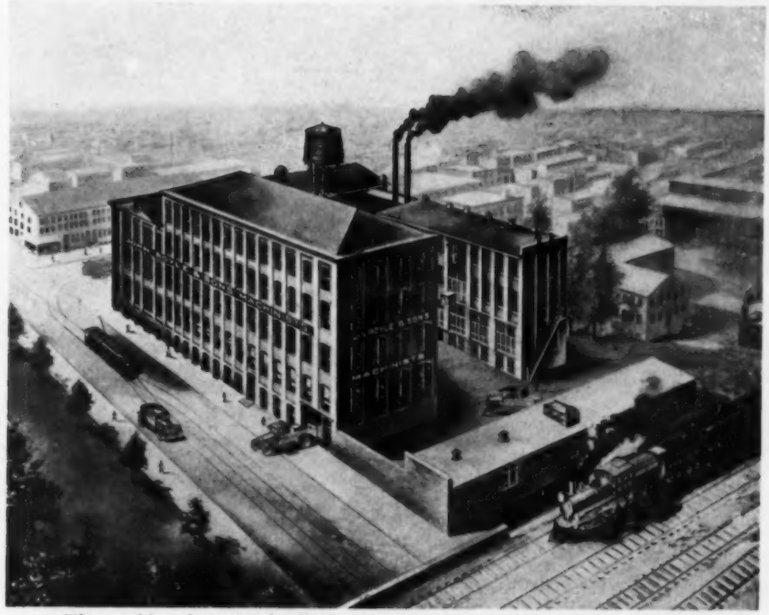
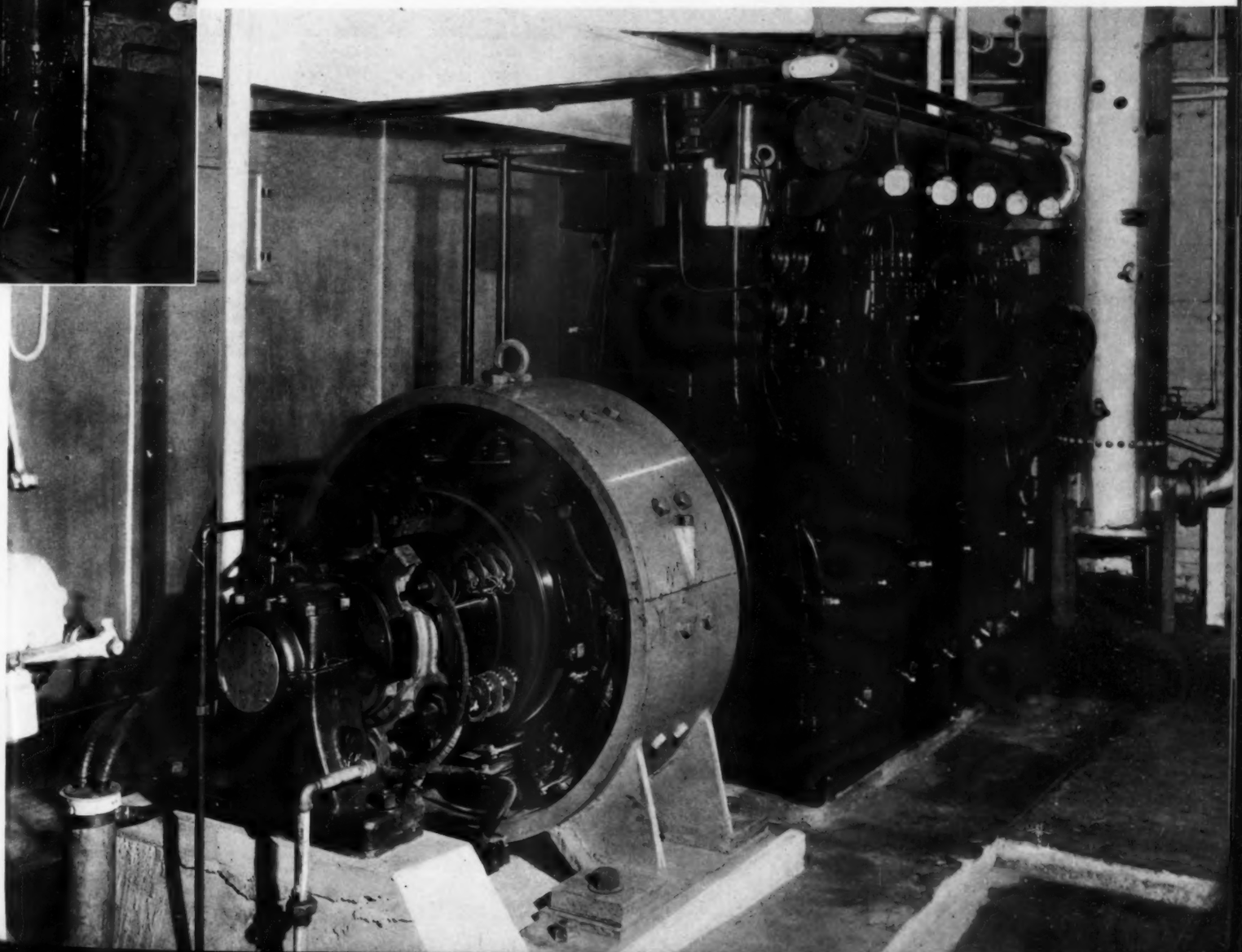


The old "boiler room" as it looked back in the days of moustache cups.



The machine shop of John Royle & Sons, Paterson, N. J. Smoke no longer goes out the chimneys. Its modern power plant installed last March, the 5-cylinder 150 hp. McIntosh & Seymour Diesel shown below, has a clear exhaust.



PARADE OF PROGRESS

AMERICA is soon to be given a heartening look at evidences of its present progress and an inspiring glimpse of the continued advancement which the future holds, through inauguration of the world's first caravan of science built to visit the people of the nation in their own home towns.

Known as the General Motors Parade of Progress, this unique traveling exposition will seek to portray, especially for that vast portion of the population living in smaller towns, the contributions of a new age of scientific progress to the comfort, happiness and welfare of 126,000,000 Americans.

An important purpose of this "world's fair on wheels," is to foster a better understanding of how industry and science work together even during depressions to lay the foundation for new advances. Specific examples of the results accomplished by industrial research are presented in the belief that an understanding of their significance will inspire increased confidence and add to the momentum of business recovery.

Heralded as a "circus of science," the huge exposition will be carried by a fleet of especially built motor transports which are themselves portents of the future. The 28-vehicle caravan, which is two miles long when in transit with units spaced at 200 foot intervals for safety and as a courtesy to other motorists, made its first public showing at ten o'clock in the morning on February 17, and will travel more than 20,000 miles within 12 months, displaying its exhibition of marvels to an audience running into millions.

In announcing the caravan, which has been completed in Detroit, Mr. Alfred P. Sloan, Jr., made the following statement:

"Industry, because of its very size, has seemed to be something apart and remote from the life of the average man. Few people realize the community of interest which exists, and must exist, between great businesses and the millions who constitute their markets. Only those developments which are good for the people as a whole are good for industry, since in-

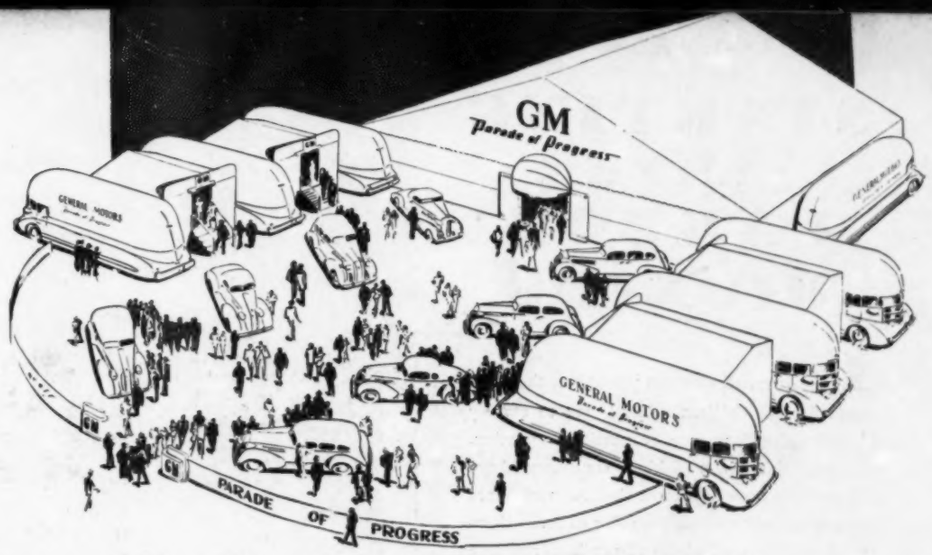
dustry both depends upon and contributes to the prosperity and buying power of the millions who buy its products.

"During the depression, therefore, industry has steadily worked with its eyes on the future. striving through the medium of scientific research to improve its products, to make those products available at lower prices, and thus to provide more employment. The General Motors Parade of Progress is being undertaken to 'bring industry to the people,' and by showing the individual citizen in his home community what the contributions of industry mean to him and his family, to establish a basis of mutual understanding and friendliness, and at the same time to increase confidence in the future progress of America.

"American standards of living are still the highest in the world. By broadening the activities of industry through scientific developments, we can have more of the good things of life, rather than accept less of them. Forces now unmistakably at work within industry itself are laying the foundations for new standards of security and opportunity.

"New developments of science, with their limitless possibilities, are providing fresh outlets for the exercise of individual initiative, which has added, and will continue to add, much to human welfare. There is plenty of work to be done, if we keep pace with scientific progress.

"Often progress has implied generalized benefits derived by large groups of people over extended periods. Our exposition, which we will take directly to the people in their home cities, is designed to show progress as it affects each and every person."



Artist's conception of the "big top" housing the General Motors Parade of Progress as it will appear to millions of Americans throughout 1936.

In visiting American cities and towns the Parade of Progress will carry along a mobile power and lighting plant with unprecedented variety of voltages and currents.

This Winton-Diesel directly connected to a 35 kw. Ideal generator is transported in a 28-foot Chevrolet tractor-and-trailer unit, one of 28 motor vehicles with scientific equipment and exhibits designed to strengthen public confidence in the future of America.

Furnishing both power for the mechanical exhibit marvels and lighting for the big silver-topped tent and the huge, streamlined exposition trucks, this mobile power plant boasts a greater variety of voltages and currents than the ordinary stationary power plant.

Instead of the usual lighting system, voltages of 220 AC stepped down to 110 AC, the General Motors Parade of Progress power plant provides voltages of 220 AC, 110 AC and 110 DC. And instead of the usual 60-cycle current, this plant will produce a current as high as 1600 cycles.

This high current will be utilized in the "circus-of-science" induction furnace, where visitors to the free exposition may witness such marvels as the boiling of an egg on ice. The visitor also may place his hand in the furnace with comfort, without burning, next to a bar of steel which the furnace is heating to a cherry red.

Here's how science accomplishes such marvels. The 1600-cycle current generated by the Winton-Diesel changes the direction of the current flow in the induction furnace coil wires 1600 times a second, setting up a terrific magnetc friction or heat on all magnetic objects in the field.

The ice upon which the egg boils is non-magnetic and therefore the ice is not affected by the magnetic friction. But the pan, in which the egg rests, is magnetic and becomes heated, boiling the water, which cooks the egg.

In the same manner, the human hand placed near the magnetic, red-hot steel bar is non-magnetic and is not affected in the least by the magnetic friction.

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The fleet being formally christened in Detroit prior to its tour of the United States. Above left: Winton Diesel and Ideal generator unit — the heart of the Parade of Progress.

STARTING WITH CARBON DIOXIDE

IT is now well over ten years since the great tuna fleet of California first began to employ Diesel drive for more economical operation. During this time, fishing conditions have changed to such an extent that the vessels are now required to cruise from five to seven thousand miles instead of the fifteen hundred mile voyages of the previous decade. Thirty to fifty day trips have become the rule rather than the exception and carry the tuna clippers through tropical waters to the Galapagos Islands and, in some cases, off the coast of Chile.

These conditions served to emphasize to the tuna fishermen not only the gratifying fuel economy of the Diesel, but, further, the tremendously increased cruising range available with the Diesel as compared with gasoline without any increase in fuel tank capacity which would otherwise seriously reduce the pay load of fish cargo.

An excellent and typical example of the Diesel application to this major industry is the tuna clipper, *Cape San Vincent*. Owned by Mr. Claude Corum of San Diego and built by the Campbell Machine Company, she was launched on May 1st of last year and entered service with the fleet on the following July 15th.

Representing an investment of over $100,000.00, this trim and efficient vessel has an overall length of 125 ft., beam of 27 ft. and draft of 12 ft. Her hull required 200,000 ft. of fir to plank sawn frames, which are 6 in. double flitches on 22 in. centers. Ample strength to bring her safely through tropical hurricanes is provided by a keel 112 ft. by 18 in. by 14 in.

The *Cape San Vincent* is powered by one 425 hp., 6 cylinder Union Diesel for her main drive and for auxiliary power carries two smaller Union Diesels of 75 and 52 hp. directly connected to two Westinghouse generators of 50 and 35 kw. capacity, respectively. These furnish current to Westinghouse motors driving two bait pumps, bilge pump and an ice machine. This latter must chill exactly one mile of 1¼ in. iron ammonia pipes in the main hold which are arranged in six banks running fore and aft. Insulation is provided by a 6 in. layer of sheet cork under the main deck.

The fifth Lux tank on the right serves a double emergency duty — smothering a fire on board or starting the Diesel when the air is lost. It is piped to the main air starting tank and thence to the Diesel below.

A particularly interesting development in this installation concerns emergency starting for the main and auxiliary Diesels in the event that starting air is lost. The owner has long viewed with extreme displeasure the practice of installing a gasoline driven compressor in the engine room as stand-by protection for the main air tank. First, he objects to the fire hazard of one small unit where all other power is either Diesel or electric driven and, secondly, the cost of these emergency units is too high, he feels, for the extremely rare occasions on which they operate.

Accordingly, Mr. Corum submitted a substitute plan to R. V. Morris & Company when he placed his order for a Lux Remote Control Type fire protection system. He desired, in brief, to install five tanks of carbon dioxide instead of four and use the additional unit to provide pressure for emergency starting. No data or previous experience was available on such service but experiments proved it to be practical and a fairly simple method of gas control was developed and installed.

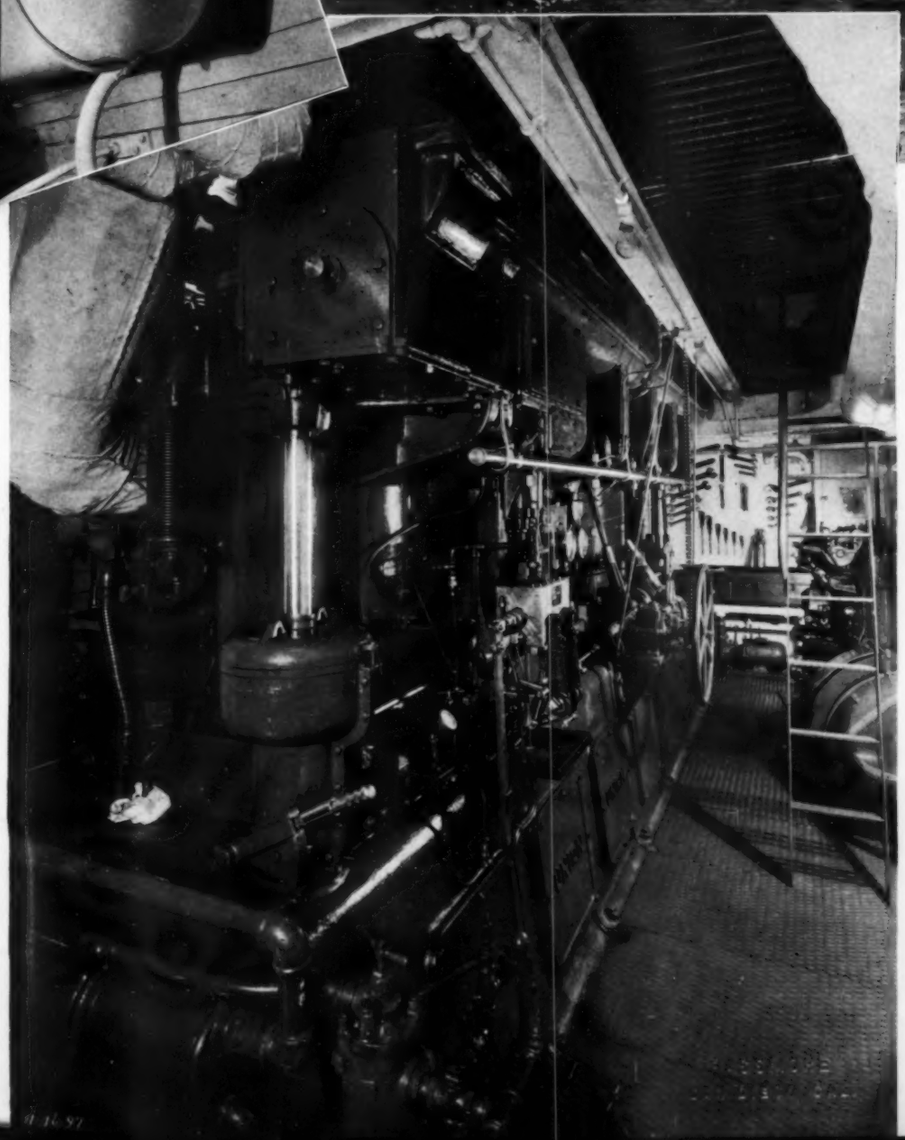
In attacking this unique problem it was necessary to meet the following requirements.

The *Cape San Vincent's* main air tank had an inside measurement of approximately 28 by 88 inches. The safety valve was set at 250 pounds and the necessary minimum air pressure for starting the main engine was 100 pounds per square inch.

The National Board of Fire Underwriters specified for protection of the engine room and bilge spaces 200 pounds of carbon dioxide or a four 50-pound cylinder installation. No diversion of any of this gas could under circumstances be permitted, therefore the first step demanded the addition of one 50-pound Lux cylinder. With a five-cylinder system, additional fire protection was available at all times, yet if the one cylinder was ever required in an emergency to start the engines, the Underwriters' requirement protection would be unimpaired.

The pipe connections from cylinder to tank followed standard practices, with the exception that the gas is taken from the cylinder through the charging port on the valve and control of discharge of gas from the cylinder maintained

The "Cape San Vincent" putting out of San Diego for the Galapagos Islands and a cargo of tuna.



by the use of the valve stem. At the tank end of the pipe line, a high pressure shut-off valve was installed, an especially designed fitting was made up for the connection into the tank and into this fitting was incorporated the special Lux nozzle which is essential to effect the necessary control of the carbon dioxide.

In practice, the system worked in a highly satisfactory manner. An initial tank pressure of 175 pounds was obtained from 50 pounds of carbon dioxide. The engines were started approximately ten times and there still remained about 125 pounds, when tests were completed. The net results and gains to Mr. Corum and the *Cape San Vincent* are first: elimination of one gasoline auxiliary compressor at a cost of approximately $500.00, plus installation; second, elimination of all gasoline from the engine room; and third, a very favorable insurance rate; in fact, it is our understanding that the *Cape San Vincent* on merit carries the lowest insurance rate of any tuna clipper.

WAY FOUND A BETTER WAY

By F. HAL HIGGINS

THE U. S. Post Office has a famous slogan about the mail must go through and neither one kind of weather nor another stopping it. Well, there's a trucking contractor at Eureka, California, who can match Uncle Sam's mail-carrying slogan since he got his Diesel truck last summer. He is A. W. Way, who has several contracts to haul Swift, Armour and Cudahy packing house refrigerated products from their South San Francisco plants to Eureka, a distance of some 280-odd miles—and mostly up-hill.

Mr. Way changed over from gasoline trucks to Diesel last summer, giving his order to the Kleiber factory in San Francisco for one of its trucks with a Buda Diesel engine. That was at a time when truckers on the coast were not ordering many Diesels because of the legislative drive in Coast states for legislation aimed to stop the Diesel on highways in competition with other forms of transport of freight and express. However, Mr. Way was looking ahead at business recovery, the future of his own business of long-haul freighting, and went ahead with his plans to Dieselize.

For the refrigerator body, Mr. Way had his own ideas and proceeded to build them into the special body that went onto his new Kleiber truck. Redwood is nearly fireproof, as the giant redwoods that can be seen along most of his route prove by blackened trunks from forest fires through the decades, centuries and ages before man trod paths and eventually built roads past them. Hence, redwood bark and sawdust as a non-conductor of heat is one of the by-products of the redwood lumber mills of which Eureka is the capitol of the industry. So, the Way refrigerator body is light and practically fireproof in spite of being wood.

Mr. A. W. Way and his Driver take a look at their Buda Diesel at the end of 36,000 miles.

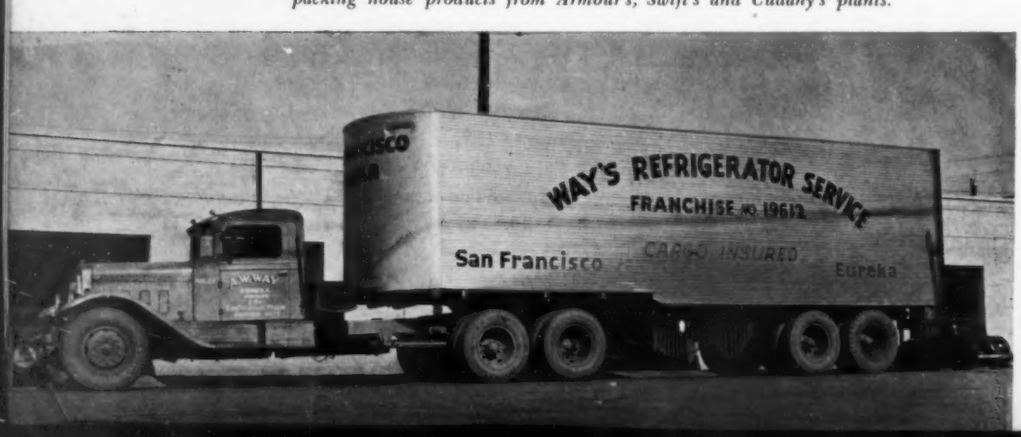
Here are pictures of Mr. Way and his famed refrigerator truck that is known all up and down the Redwood Highway for dependability. It has just turned 36,000 miles on the speedometer, making 60 round trips between South San Francisco and Eureka. Pick-ups around San Francisco besides its packing house products from South San Francisco make a round trip average about 600 miles. Let Mr. Way tell of his truck and its performance here:

"It takes us about 14 hours to run up from here with an average load of 17 tons. The last trip north was through fog and rain after about two weeks heavy rains that had the rivers out of banks in many places. We ran through water over the road to a depth of 4½ feet for about 100 yards and for a mile the water over the paving was over 2 feet deep. That stopped the automobiles and gasoline trucks, but we went through O. K.

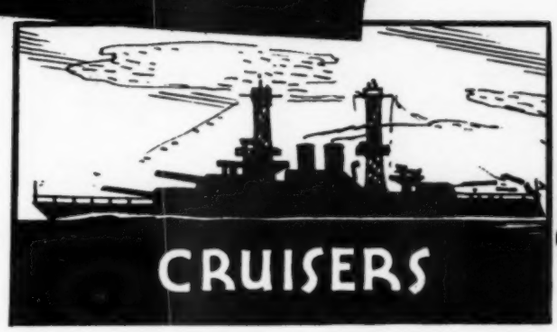
"This motor is burning a 27 plus Diesel fuel, taking from 80 to 100 gallons for a round trip, depending on load, weather, the amount of running around town for pick-ups, etc. We are using Union's Triton lubricating oil, changing oil each round trip. We formerly took 250 gallons of gas for this trip, by the way, before we changed to Diesel engine.

"Besides the great saving in fuel costs, we get better tire mileage, have better control of the truck and load on grades, can absolutely depend on the motor taking us through on schedule without roadside failures, and we are free of fire hazard. As I had one 14-ton load with trailer burn with two men in the hospital for weeks under gasoline trucking conditions, you know I stress this point strongly. Well, we have solved the long-haul trucking problem. I am thoroughly sold on the Diesel engine in a truck for this job."

Way's Diesel-powered Kleiber truck loaded with 17 tons of refrigerated packing house products from Armour's, Swift's and Cudahy's plants.



92 SHARPLES LUBRICATING AND FUEL OIL PURIFIERS SUPPLIED TO U. S. NAVY



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It is a known fact that precision parts and assemblies are the most important factors of the Diesel Engine.

You cannot expect to have a smooth and efficient running engine if you do not put into that engine, well-made and accurate-made Precision parts and assemblies. If you use such parts, it would be to your advantage to contact a leader in the manufacture of such items.

Marquette Metal Products Company is a known leader and has had considerable experience in the field of Precision parts and manufacture. We can assure users of quality and service.

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AIRCRAFT

DIESEL

REFRIGERATION

AND AUTOMOTIVE PRECISION PARTS

AND ASSEMBLIES

FLORIDA RESORT

. . . . *Continued from page 25* . . . .

In addition to operating the Sulphur Springs resort the activities of the Peninsular Distributing Corp., are unusually diversified. The Corporation has 800 acres of orange and grapefruit groves from which it packs annually an average of 150,000 boxes of fruit at its own packing plant located at Thonotosassa, 15 miles east of Tampa.

At the Thonotosassa packing plant a McCormick-Deering Model 300 power unit supplies power for operating washers, polishers, conveyors, and other equipment. This unit, placed in service in August, 1930, has now been operated for five eight-month seasons, during which it has considerably reduced power costs as compared to purchased power formerly used.

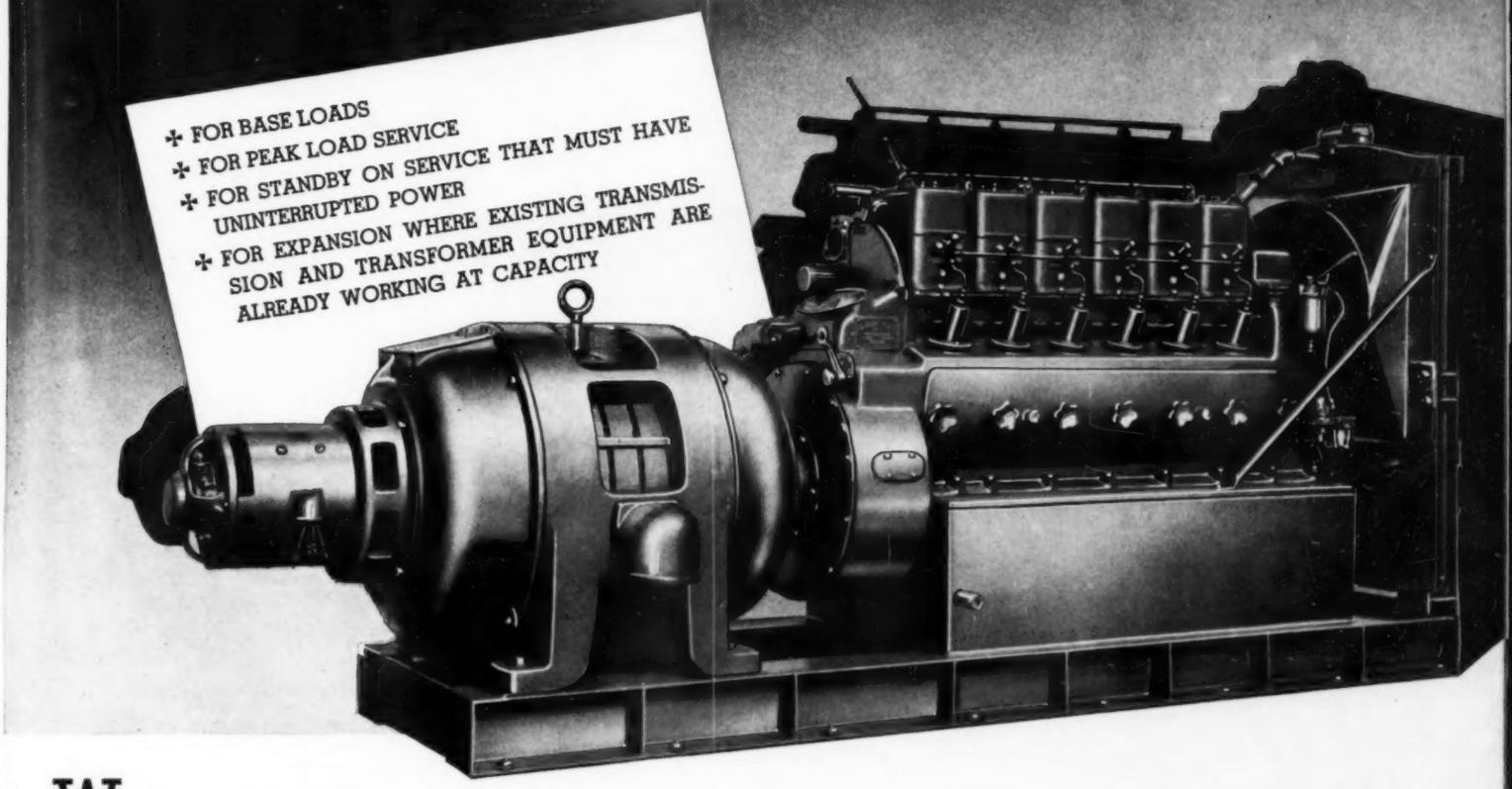
Mr. Harris, an experienced fruit grower, has been in Florida since 1923. Prior to that time he was engaged in fruit growing on the Isle of Pines for more than fifteen years. Peninsular citrus groves, however, come under the direct supervision of J. P. Tyner, superintendent of production. This year, as for several years past, Mr. Tyner has also supervised the raising of watermelons, which contribute materially to the Corporation's income. The 1935 crop, marketed in May, was produced on a 300-acre tract of rented land from which the timber was cut in August a year ago. In clearing watermelon land, the stumps are not removed mainly because the soil in this particular section of Florida will not produce more than one crop of melons a year and after the land has been used for this purpose it is seldom good for another crop for several years. Fertilizer is used extensively in the growing of watermelons, about one-half ton being required to the acre in this section.

Another big project of the Peninsular Distributing Corp., is the manufacture of fertilizer in its Tampa plant, which is designated as the Peninsular Fertilizer Works and which produces about 10,000 tons each year, supplying not only the Peninsular Corp.'s requirements but doing a lucrative commercial business as well.

Near Tampa also are the Corporation's rich humus beds from which the humus used with other ingredients in fertilizer is produced. This material, containing about 90 per cent pure organic matter and about 3 per cent organic ammonia, is especially valuable in fertilizer used on Florida land due to its moisture-retaining qualities.

MARKS THE SPOT

...where an F-M "36-A" Diesel Driven Generating Set Can Serve Your Business


✣ FOR BASE LOADS
✣ FOR PEAK LOAD SERVICE
✣ FOR STANDBY ON SERVICE THAT MUST HAVE UNINTERRUPTED POWER
✣ FOR EXPANSION WHERE EXISTING TRANSMISSION AND TRANSFORMER EQUIPMENT ARE ALREADY WORKING AT CAPACITY

WHICH one of these conditions applies in *your plant?* If power costs for the plant are too high ...if peak load service demands additional power ...if present equipment is already loaded to capacity—then an F-M "36-A" Diesel-driven generating set is needed on the job. These compact, powerful "packages of power" take up little space, burn cheap grades of oil, need little attention. In return, they deliver current where it's needed, *when* it's needed, at amazingly low cost. Why not find out *today* how they can serve *your* plant? For full information, address Dept. F-81, Fairbanks, Morse & Co., 900 South Wabash Ave., Chicago, Ill. 34 branches at your service throughout the United States.

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Diesel Engines

POWER, PUMPING AND WEIGHING EQUIPMENT

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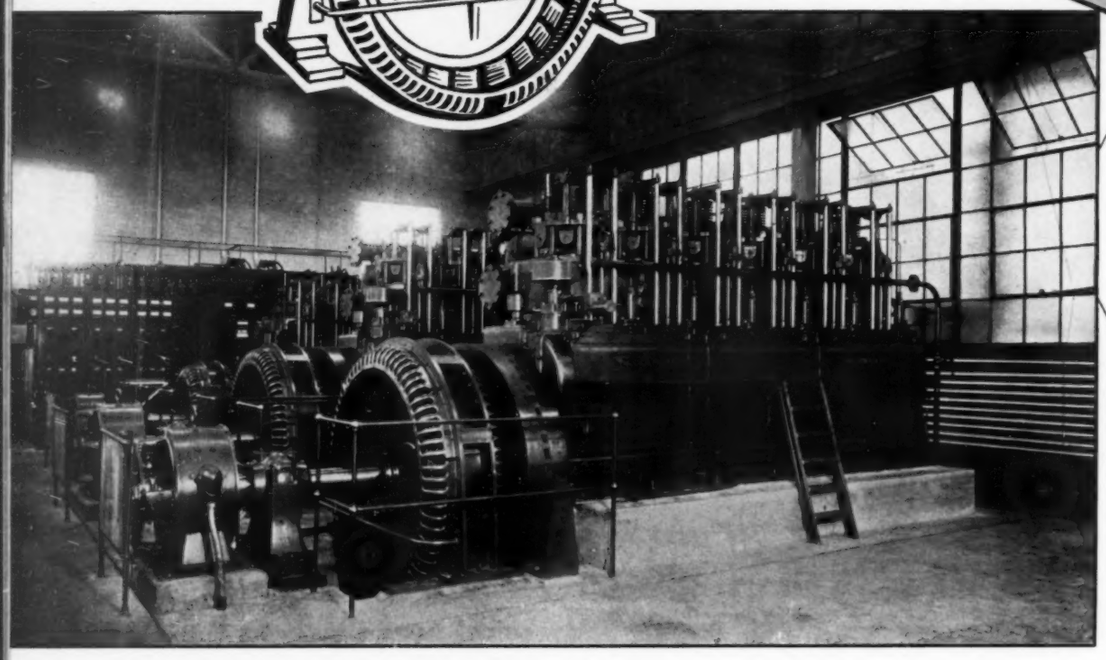
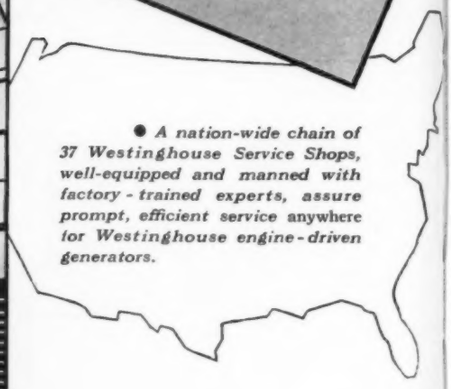


OVERNIGHT SERVICE... Anywhere



● *A nation-wide chain of 37 Westinghouse Service Shops, well-equipped and manned with factory-trained experts, assure prompt, efficient service anywhere for Westinghouse engine-driven generators.*

● *City of Bath, N. Y. Two 375 kv-a. and one 250 kv-a. Westinghouse generators driven by Worthington Diesel Engines. In the background is a Westinghouse steel switchboard.*

EXTRA VALUES

- Protection against shutdowns —tests that safeguard against insulation flaws.
- Solid steel rotor that stands the gaff.
- One source for all generator auxiliaries.
- Positive ventilation for cool running — long life.
- High efficiency at all normal speeds.

YES, just as you would expect of any good generator, Westinghouse ES generators are matched to the Diesel engines that drive them. They have long life, high efficiency, effective ventilation . . . all the features that assure continuity of service and minimum maintenance.

But over and above these considerations stand the *extra values* you get from Westinghouse. *Service* is one of these, and a mighty important thing to keep in mind when you buy a Diesel generating plant.

Westinghouse service is always within a few hours' reach. Don't wait 'till something happens to find out what kind of service facilities the manufacturer has. Weigh that in your original decision.

Write or telephone to our nearest office for further information on type ES generators. R-51002

Westinghouse

ENGINE-DRIVEN GENERATORS

W WESTINGHOUSE ELECTRIC

PARADE OF PROGRESS

. . . . *Continued from page 37* . . . .

The Winton-Diesel in the trailer also will provide power for such other scientific exhibits as the following:

The stroboscopic demonstrator, which causes an automobile crankshaft, revolving at the rate of 1700 revolutions per minute, to appear as though it were standing stark still so that observers actually may see how drops of oil flow through this moving part. A neon light flooding the revolving crankshaft flickers from one to 1700 times per minute. Acting much after the manner of the shutter on a movie camera, this flickering light "freezes" the movement of the crankshaft momentarily, according to the rate of flickers per minute, allowing the human eye to observe the action of the crankshaft and the oil within it.

The electric device which will project the voices of visitors over a light beam so that they may actually see their voices across the width of an exhibition truck. A cathode ray oscillograph turns the pressure waves of the voice into visible light waves, which may be seen on the nearby screen.

The delicate meter, developed by General Motors Research Laboratory engineers, which measures pressure in millionths of an inch. This instrument, used by workers in the finer steels, measures the infinitesimal pressure exerted by the finger of a small child as it "bends" an ordinary 140-pound steel rail. The pressure exerted by the finger, recorded on a stack of small carbon disks immediately beneath the rail, causes an electric circuit to register on the meter in millionths of an inch.

The "electric" eye, which enables a visitor to project his voice on a beam of light several feet distant to a loud speaker.

The lighting system, furnished by the Winton-Diesel power plant to the big silver-topped tent and auxiliary exposition trucks, will be similar to that used at the Chicago World's Fair. Large inverted mushroom type reflectors on higher-than-head standards will provide indirect light.

Coated outside like all other of the exposition trucks in striking silver and red Duco, the power trailer-truck is painted on the inside in white and gray. As with all exhibits at the exposition, the power truck will be open to the free inspection of the public.

From 5 to 120 H.P.

28 HILL-DIESEL MODELS 35 YEARS EXPERIENCE
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Hill-Diesel Engines meet your requirements! Featured by a perfected combustion system which includes the famous single orifice nozzle, they operate safely, economically and dependably. Large hand holes facilitate ready inspection of bearings and removal of pistons without disturbing base or cylinders.

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WITH QUESTIONS AND ANSWERS

Stationary—Marine—Locomotive—Automotive
By ORVILLE ADAMS, Consulting Diesel Engineer
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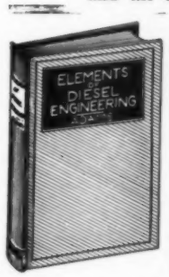
478 (6 x 9) Pages **Price $4.00** **284 Illustrations**

An Indispensable Guide for Students, Mechanics, Repairmen, Owners, Operators, Manual Training and Vocational Instructors and all desiring a thorough knowledge of Diesel fundamentals.



WRITTEN by a recognized authority on Diesel Engineering. The author is a man with a specialized education and with experience in training men for business and industrial work. In addition to writing extensively on Diesel Engines, Mr. Adams is the author of widely sold text books and has helped prepare important training courses on the subject of operation, care and repair of all types of modern Diesel power plants.

The increasing use of Diesel Engines in the automotive, marine, stationary and locomotive fields will require thousands of trained men during the next few years. The purpose of this new book is to help prepare men to enter this wide field for profitable and interesting employment. Many ambitious men are preparing themselves for the specialized and expert work in connection with the manufacture, sales and servicing of this prime mover.

Information never before available is included in this new book, which combines in one volume, a text for study and reference — and a practical manual on operation and repair.

An informative text for home and school use. All Mechanics and Engineers should know Diesel principles!

This book includes much original data based on the author's operating and servicing work on Diesel Engines for over twenty years.

This book contains twenty chapters with Questions and Answers for Review. One Chapter is devoted to Elements of Diesel Operation and Standard Definitions. Four Chapters deal with Combustion Chambers, Fuel Systems, Injection Pumps and Fuel Injection Nozzles. Three Chapters deal with Lubricating Oils, Air Intake and Exhaust Systems and Selection Rules. Three Chapters give all Details of High Speed Engine Development. Three Chapters are given on Operation and Maintenance of Automotive Diesels, and Field Maintenance of Auxiliaries and Accessories requires Two Chapters. Considers all Essential Operating Principles.

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"Ratchet your way out of costly shutdowns" with a speedy, power-duty Snap-On ratchet with interchangeable Loxockets. No tool you can buy will pay for itself so quickly — and we build several sizes, one of which will fit your needs.

This one is 24½" overall, with a detachable head as compact as a prize fighter's fist — and every pull is a knockout punch to bolts and nuts.

Above you see how 1800 handhole plates are taken off and replaced on a battery of four water tube boilers, twice a year. Snap-On wrenches — safe, powerful, speedy and well balanced—cut time on this job up to 75%.

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Without obligation ☐ Send free catalog
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Your name_____

RED RIVER LUMBER

. . . . *Continued from page 21* . . . .

Average distance	2,500 ft.
Operating hours	7
% of operating hours	17.1
% of total scale	30

This particular Allis-Chalmers tractor was geared for top speed of 5 miles per hour.

The details of the Ingersoll-Rand switching locomotive put into service by the Red River Lumber Company in September 1926 may likewise be of interest:

Weight in lb., working order	213,500
Power plant	Two Ingersoll-Rand Diesel Engines
Total hp.	600
Driving motors	Four in number
Wheel base	Driving 36′ 2″ Rigid 7′ 2″ Total 36′ 2″
Axles	Journal size 6½ x 12

Tractive effort in pounds	Speed-Miles Starting	
60,000	5.3	1 hr. rating
25,000	10	
15,000	30	Max. speed

MODERNIZED BY DIESELS

. . . . *Continued from page 34* . . . .

solved by interconnecting a standard vertical, oil-fired boiler with the waste heat boiler. The oil burner in the vertical boiler is automatically controlled by the steam pressure generated in the waste heat boiler. If the pressure falls below fifteen pounds, the oil burner starts to operate, and when it reaches fifteen pounds the oil burner automatically cuts out.

The Royle machine works manufactures a varied line of extruding machines used in the making of rubber and plastic products, jacquard loom card cutting machines, circular looms for weaving fire hose, a full line of routing machines used in photo engraving and several other highly specialized processing machines. Its products are shipped to every country in the world. Normally the plant employs about 100 people.

John Royle & Sons may be an old company from the standpoint of years it has been in business, but when it comes to selecting power it has young ideas. It chooses Diesel.

Engine Hood Lined with Burgess Acoustic Treatment

Don't let
Diesel Engine Noises bother you!

Absorb them with the
New Burgess
Acoustic Engine Hood

An ordinary housing is not enough to silence engine noises—it must be designed by acoustic engineers to *absorb* —not subdue—such disturbances. It must have an intake silencer and the entire hood must be lined with flameproof sound-absorbent material. The Burgess Acoustic Engine Hood provides these advantages.

Burgess hoods and silencers are individually designed for each make and model of Diesel engine.

The low restriction impingement-type air cleaner and intake silencer are optional equipment.

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INTERSTATE COMMERCE COMMISSION

Quotations from Report Covering Investigation of Accident to Atchison, Topeka & Santa Fe Railway Locomotive Unit 1-A

REPORT OF THE CHIEF INSPECTOR, BUREAU OF LOCOMOTIVE INSPECTION, COVERING INVESTIGATION OF ACCIDENT TO ATCHISON, TOPEKA & SANTA FE RAILWAY LOCOMOTIVE UNIT 1-A NEAR DILCO, N. MEX., NOVEMBER 20, 1935.

December 20, 1935.

TO THE COMMISSION:

On November 20, 1935, about 7:21 p.m., near Dilco, N. Mex., a fire occurred in the engine room of Atchison, Topeka & Santa Fe Railway Diesel-electric locomotive unit 1-A while the unit, coupled to and leading unit 1-B, was hauling a special train of standard passenger train equipment at a speed of approximately 75 miles per hour. The locomotive consists of units 1-A and 1-B, each equipped for multiple unit operation and alike in all respects. Both units were built by the Electro-Motive Corporation at the plant of the St. Louis Car Co., St. Louis, Mo., in August 1935. Unit 1-A only was involved in the accident.

Motive power for each unit is supplied by two 900 horsepower Diesel-electric power plants mounted on the underframe directly over each center plate.

An auxiliary engine and a heating boiler are located in the center portion of the engine room between the two main power plants. The auxiliary engine is a 90-horsepower Diesel direct connected to a generator used for charging the storage batteries, and belt connected to an air compressor and a traction motor blower fan which draws air from the outside and delivers it to the traction motors. The air compressor is clutch connected to a refueling pump mounted adjacent thereto.

Two fuel tanks, each of 400 gallons capacity and connected to a common sump, are mounted under each unit. Filling holes for these tanks are provided in the outside walls to permit filling the tanks from the outside. The filling holes are equipped with safety plugs designed to prevent flame from entering the tanks and to relieve any pressure therein.

Each fuel tank is provided with one 1-inch and one 2-inch vent pipes. The 1-inch pipes extend through the bottom of the manifold well and terminate in return bends below the level of the roof. Fuel for the engines and heating boiler is pumped from the fuel sump and delivered at low pressure to the injection valves on the engines and to the heating boiler, and excess fuel is returned from these points to the fuel tanks through return lines connected to the 1-inch vent pipes. The 2-inch vent pipes extend to approximately the same height as the 1-inch pipes and terminate in return bends near the vertical wall of the exhaust manifold well and inside of the engine room.

The refueling pumps, one in each unit, heretofore referred to as being clutch connected to the air compressors, were installed to permit refueling from tank cars or tank trucks by means of hose extending from the source of supply, through a side window, and thence to the refueling pumps. These pumps were installed as a temporary means of filling the fuel tanks pending establishment of suitable wayside filling stations.

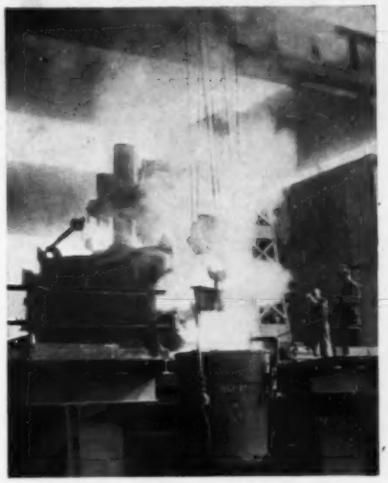
An additional supply of fuel was carried in two tanks in a baggage car of the train from which a line laid on the floors, approximately 125 feet long, consisting of a steel armored hose, pipe, and fittings, extended through the two units and connected with the refueling pump in each unit. This arrangement had been in use for some time to refuel enroute. There was a valve in this fuel line in the baggage car and a valve at each pump.

The locomotive, hauling 8 cars of standard passenger train equipment, departed from Chicago, Ill., at 7:00 p.m., November 19, on a projected continuous run to Los Angeles, Calif. At Gallup, N. Mex., one of the crew changing points, and 1,500 miles from Chicago, a stop of about 2 minutes duration was made during which time the regular crew was changed, and the No. 1 or forward engine in unit 1-A was cut out on account of a scored cylinder.

The train departed from Gallup at 7:13:30 p.m., November 20, and after having proceeded a distance of about 7 miles, near Dilco, N. Mex., at 7:21 p.m., while running at a speed of approximately 75 miles per hour on a 0.5 percent descending grade, fire was discovered in the engine room of unit 1-A.

Apparently the fire was first discovered by L. W. Goodrich, the carrier's supervisor of Diesel locomotives, and a service engineer representing the builder of the locomotive who were riding in the operator's cab at the rear end of unit 1-A. Smoke was noticed coming from between the units and they immediately started forward through the engine room on the right side to reach the fuel pumps but were unable to get through the right aisle on account of intense fire. The supervisor of Diesel locomotives finally succeeded in getting through the left aisle and into the front cab. At the time of passage through the engine room, flames extended from the floor to the roof at about the center of the room in the vicinity of the auxiliary engine and air compressor, and fuel oil was falling

National Forge and Ordnance Company
Irvine, Warren County, Penna.



All National Forge and Ordnance Company products are manufactured from fine quality Basic Electric Steel.

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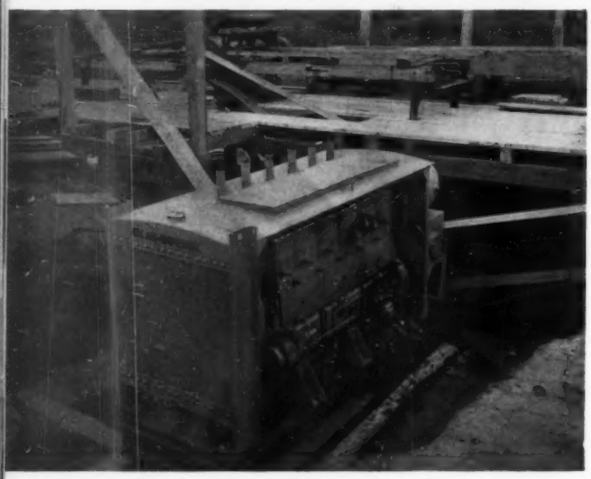
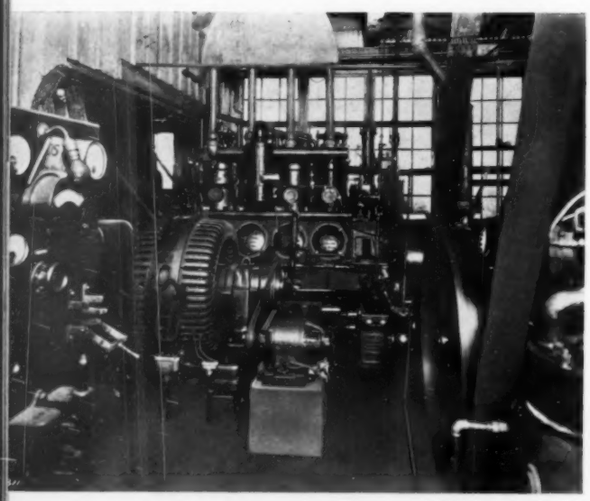
There are in the woods today more shovels and excavators powered with Atlas Diesels than with the Diesels of all other American manufacturers combined. They are used primarily for preparing the roadbed for the logging railroads.



In working isolated stands of timber it has been found more economical to saw the lumber right on the spot and bring out a finished product rather than haul the logs to a distant mill. Atlas Diesels are preferred for "gyppos" because of their ready portability, fuel economy and fire safety.



Here is an Atlas Diesel which furnishes the power for the machine shop at the Headquarters Camp of the Weyerhaeuser Timber Company of Longview, Washington.

The tug "TYEE," one of a fleet of Puget Sound tugs used in towing log rafts and hogged fuel, was converted from steam to Atlas Diesel power five years ago. This conversion gave her twice the power, eliminated two men, increased her cruising radius five times and effected a fuel saving of 80%.

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2. The Atas Diesel powered rig requires but one man to operate. The steam rig requires three — one man to cut the wood — one to feed the boiler — one to operate. The fuel oil cost is so much less than the value of marketable timber burned — that Diesel operation is most economical in the very midst of wood fuel.
3. The steam rig always presents the problem of a suitable water supply, with attendant pumping and piping costs. The Diesel radiator requires a negligible amount of make-up water, so that eliminates the water problem.
4. The Atlas Diesel is absolutely fire safe — it never backfires and will not emit sparks or flames that start forest fires. The great economy of fire safety cannot be overestimated.

The specific application of Atlas Diesels to lumbering and logging operations is one of the nine industries covered in our stationary Diesel engine catalog. A request on your business letterhead will insure prompt receipt of your copy.

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OAKLAND, CALIFORNIA — MATTOON, ILLINOIS

•

Because of their great power, economy and fire safety, Atlas Diesels are especially adaptable for yarders, skidders and loaders. Below is an Atlas Diesel powered Lidgerwood yarder in the Crown Willamette woods in Oregon. Its operating cost is $3.00 per day, effecting a great saving contrasted to $25.00 a day for a comparable steam donkey.

from the roof in considerable volume which saturated parts of his clothing. As he entered the cab from the engine room he attempted to leave the unit through the cab side door near the engine room door but was confronted by a sheet of flame and burned about the face and neck. He then crossed over to the right side of the cab. By the time he reached the cab the occupants had discovered the fire and measures had been taken to stop the train.

When the fire was discovered by those in the front cab the throttle was closed immediately and the brakes were applied. One of the occupants observed that the fire seemed to be confined to the vicinity of the air compressor and it did not, for the instant, seem to be of major proportions. He obtained a fire extinguisher and attempted to go into the engine room but when the door leading thereto was opened the fire apparently built up at once, seemingly filled the engine room, and the cab was immediately filled with hot gas and smoke. The occupants of the cab were forced to seek egress through the windows and right side door where they hung on until the train was brought nearly to a stop.

The service engineer who was riding in the rear cab with the carrier's supervisor of Diesel locomotives had been in the engine room of unit 1-A as far as the auxiliary engine shortly after leaving Gallup and at this time he observed conditions were normal. When the fire was discovered, estimated as 2 to 5 minutes after he left the engine room, he returned to the engine room with the suvervisor for the purpose of stopping the fuel pumps. He stopped the rear main power plant by means of the overspeed trip, but found that it was not possible to reach the fuel pumps because of the fire; then being unable to find the supervisor he returned to the rear cab. Another attempt was then made to enter the engine room and reach the fuel pumps, but the flames blew back toward the rear apparently due to the opening of the louvers in the front air intake: he then returned to the rear cab and thence to unit 1-B at which time flames were coming up between the two units.

The fireman (engineer's helper) and an attendant whose duty it was, among other things, to operate the refueling pumps for transferring the fuel oil from the baggage car to the fuel tanks on the units, were engaged in carrying lubricating oil from unit 1-B to unit 1-A at the time of the fire. Refueling of unit 1-B was completed shortly before reaching Gallup; normally unit 1-A would be refueled immediately thereafter but the operation was delayed because of the stop at Gallup. Leaving Gallup the attendant and the fireman were called upon to carry the lubricatin oil from unit 1-B to unit 1-A.

When the train stopped, approximately 1 mile from the point of application of the brakes, flames were coming from the roof and from under the forward part of unit 1-A and there was oil on the ground under and in the immediate vicinity of the unit.

As soon as possible after stopping, unit 1-A was uncoupled from unit 1-B and the train was backed away from the burning unit to avoid damage to unit 1-B and the remainder of the train.

The Gallup fire department attempted to extinguish the fire but were unable to do so because of shortage of chemicals. A steam locomotive was then placed on an adjacent track opposite the burning unit and the fire was extinguished by the discharge from a blow off cock.

Examination of the roadway and track by the carrier's representatives immediately after the accident showed that there was oil on the roadway and rails for approximately 4 miles back from the point where the train was stopped and the condition of the rails indicated that wheels had been sliding for about three-fourths of a mile. It was later found that 20 pairs of wheels in the train were slid flat.

After a preliminary examination of the unit at Gallup, N. Mex., the superstructure was sealed to prevent entry and the unit was hauled by unit 1-B to the shop of the Electro-Motive Corporation at La Grange, Ill., where a detail examination was made.

Examination of the interior showed that the fire had extended from the forward end of the rear main engine to the front end of the front operator's cab. Apparently the damage in the cab occurred largely after the train stopped due to entrance of the flames through the door to the left side of the engine room, which had been left open after the supervisor passed through the engine room, and through the openings in the partition around the generator. The glass in all except one cab window had been cracked by the heat.

The roof sheets over this section of the unit and the side sheets were distorted, most of the wiring conduits with contained wires were destroyed, the 3-inch copper circulating pipes to the main engine radiators and the radiators were melted, and also the return fuel lines. The air silencer intake was consumed, aluminum casings and covers of parts of the main engine and air compressor were either burned or consumed entirely, and a section of the fuel line that extended from the baggage car through unit 1-B and into unit 1-A was burned. The bell, which had been mounted in the exhaust manifold well, was melted and formed into a brass slab about 3 feet long, one-half inch thick, and varying widths, with the clapper embedded therein.

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The fire under the front part of the unit was confined principally to the vicinity of the front truck. The insulation was burned off the motor leads and the electrical apparatus otherwise damaged. The front ends of the fuel-oil tanks were exposed to the fire but were not damaged.

The fuel tanks in the baggage car were refilled at Albuquerque, N. Mex., 160 miles east of Gallup. Refueling of unit 1-B through the hose line from the baggage car was completed shortly before reaching Gallup; normally unit 1-A would have been refueled immediately thereafter but the operation was delayed by the stop at Gallup. Leaving Gallup the fireman and the attendant who operated the refueling pumps were called upon to carry lubricating oil from unit 1-B to unit 1-A and the fire occurred while this work was being performed.

The handle of the clutch on the air compressor that was used to drive the refueling pump was found in partially engaged position; the pin provided to hold this handle in off position was not in place. When the casing covering the drive mechanism was removed it was found that the clutch jaws were engaged sufficient to operate the pump, although the attendant stated that he had not started to refuel unit 1-A. The valve on the inlet side of the refueling pump was open approximately five-eighths of the total area through the valve; the corresponding valve on unit 1-B was closed. The valve connecting the oil tanks in the baggage car to the refueling line extending from the baggage car to units 1-B and 1-A was open. The analysis of the oil in the fuel tanks in unit 1-A after the fire showed conclusively that the tanks had been refilled from the tanks in the baggage car after the latter tanks had been refilled at Albuquerque. The float of the oil gage provided to show the level or quantity of oil in the fuel tanks of unit 1-A was at the bottom of the tank, and a leak was found in the float.

Oil was found on the roadway and rails for approximately 4 miles back from the point where the train was stopped. After about the first 10 rail lengths the quantity of oil found on the roadway and track was uniformly distributed, indicating continuous leakage over the entire distance.

The tanks in the baggage car, after refilling at Albuquerque, contained 3,385 gallons; the quantity of oil in these tanks after the accident was 2,355 gallons, or a reduction of 1,030 gallons from Albuquerque to the point of accident. The quantity of oil from the tanks in the baggage car used to refuel unit 1-B between Albuquerque and Gallup was 340 gallons; on the basis of equal fuel consumption of the two units approximately the same quantity of oil would have been required to refuel unit 1-A after leaving Gallup, or a total of 680 gallons to fill the fuel tanks of both units. The difference between the reduction in the number of gallons of oil in the tanks in the baggage car and the quantity required to fill the tanks of both units represents 350 gallons, which is the quantity of oil that overflowed from the vents and from the refueling hose after it burned off.

The fuel tanks under unit 1-A lacked approximately 50 gallons of being full after the fire, measured when the oil was cold; this discrepancy in gallonage from full tanks to 50 gallons less than full is readily accounted for by temperature change and by evaporation which no doubt took place while the tanks were subjected to the heat of the fire.

The nominal capacity of the refueling pump was 150 gallons per minute at the speed at which it was normally operated, but due to restrictions in the long inlet line it is doubtful if more than two-thirds of this capacity was realized. Taking into consideration the speed of the train it would appear that the pump started to operate at about the time the train departed from Gallup, that the tanks were filled in the first 3 to 4 minutes of movement of the train, and that the pump continued to operate thereafter until interfered with by the fire.

Two 2-inch vent pipes from the fuel-oil tanks extended to approximately the height of the engine room and terminated in return bends so located that the overflow would discharge downward through the radiators and into the engine room; some of this overflow oil may have flowed out through a small observation hole in the engine room floor near the rear of the forward main engine and in the vicinity of the auxiliary engine, which was used for the insertion of a periscope to observe the wheels while the train was in motion, and through other parts of the floor that may not have been oil tight. When the fire was first observed the point of greatest intensity appeared to be in the vicinity of the air compressor, and the auxiliary engine. Two 1-inch vent pipes terminated in return bends so located that the overflow would discharge into the exhaust manifold well in the roof. Drains led from the exhaust manifold well to underneath the unit though it is probable that some of the discharge would reach the engine room through leakage as the well was not of leakproof construction.

The forward main engine had been cut out at Gallup; the intake fans at that end of the unit were therefore not in operation and the louvers in the forward air intake, which operated automatically in accordance with the temperature of the cooling water, were probably closed when the fire started but apparently opened thereafter. The louvers in the rear air intake were blocked open. The strong blast of air from the fans driven from the rear engine,

which delivered 50,000 cubic feet of free air per minute at full engine speed, would readily break up the dripping oil into small particles and assist in forming a readily combustible mixture. Tests of oil from the fuel tanks of unit 1-A showed the flash point, open cup method, to be 220° F., fire point 245° F., and gravity (API) 37 at 60° F.

The direct cause of the accident was improperly located outlets to the vent pipes which discharged the overflow from the fuel oil tanks into the engine room.

The oil tanks were overflowed, in the absence of an attendant, by oil from a hose line extending from tanks in a baggage car to a refueling pump in the engine room of the unit. Manually operated stop valves in the hose line, at the tanks in the baggage car and at the refueling pump inlet, were found in open position. The jaws of the clutch mounted on one end of the air compressor shaft that drove the refueling pump, which was used for transferring oil through the hose line to the fuel tanks of the unit, were found engaged and the pin provided to hold the clutch handle in off position was not in place. The cause, or causes, for engagement of the clutch, and the manually operated stop valve at the inlet of the refueling pump being open, could not be determined. The stop valve at the tanks in the baggage car had been left open by the attendant after completion of refueling of unit 1-B as he had anticipated refueling unit 1-A immediately thereafter, but this operation was interfered with by the stop the train made at Gallup and by being called upon to perform other work when leaving Gallup.

The presence of this refueling arrangement on the unit was a violation of rule 256 of the Rules and Instructions for Inspection and Testing of Locomotives Other Than Steam, which reads:

> "Fuel reservoirs shall be arranged so they can be filled only from outside of the cab or other compartments."

The fuel oil that was discharged into the engine room from the vicinity of the roof was mixed with air by a strong blast from the cooling and ventilating fans driven from the rear main engine and formed a readily combustible mixture. The exact cause of ignition was not determined, but a number of theories were advanced as to the possible causes, among which are the following:

> Mixture being blown against the hot exhaust stack of the auxiliary engine, the smokestack of the heating boiler, the hot casting on top of the heating boiler, or drawn through the slotted openings into the boiler fans and thence blown against the red hot cover of the combustion chamber of the heating boiler.
>
> Sparking at commutators of heating-boiler motors or auxiliary generator.
>
> Sparking at storage-battery connections, temporary connection having been made across three front cells by clips and loose wiring which were found on top of the batteries after the fire.
>
> Sparks from the brake shoes at the time the running test of the brakes was made leaving Gallup. While there was normally considerable oil scattered on the trucks, piping, and fuel tanks, those who participated in the investigation were generally of the opinion that the source of the fire was within the engine room, rather than external.

Respectfully,

JOHN M. HALL,
Chief Inspector.

TO WHICH THE EDITOR ADDS:

"The Santa Fe had been testing this locomotive over the entire railroad, running and re-running many divisions, not only to determine the performance possibilities of the locomotive but also the ability of standard coaches and Pullman cars to operate at sustained high speeds. Likewise to determine the effect on track of equipment operating at high speed, looking also to deciding what constituted comfortable speeds over certain mountain divisions.

"Under these circumstances it was impossible for them to know from day to day where they were going to need fuel, and at the time of the accident they were on the final run of this kind with guests aboard, primarily to get the reaction of disinterested people to a schedule of somewhere forty and forty-three hours between Chicago and Los Angeles: their particular interest on this trip being to observe the effects of major track changes they had made based on previous runs with the same equipment.

"Therefore, they had provided a fuel arrangement as described, so as to have with them sufficient fuel for these long trips. Unfortunately, a man failure occurred in the fueling operations leaving Albuquerque, which spotted considerable fuel into the locomotive. The facts are there were a series of man failures, and looking back over the events it hardly seems possible that all of these failures could have occurred in such perfect order as to have resulted in the accident: but they did.

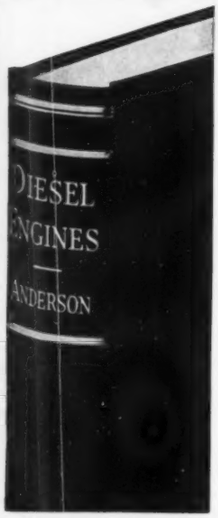
"The report comments on the fuel tanks being so vented as to allow the discharge to return to the cab: while this is true, it is the only case in some six hundred odd pieces of equipment previously built by the Electro- Motive Corporation and was a concession to streamlining. I feel sure that if this vent arrangement had discharged such a quantity of fuel to the atmosphere over the roof of the locomotive and back over the train, the disaster would have been even greater under these circumstances.

"As you will observe from the description, there were two main power engines, 900 horsepower each, and one small auxiliary engine in that cab, but the power engine at the point of fuel discharge and fire was shut down before the fuel escaped into the cab and before the fire originated; therefore, was in no way responsible for any of the things that happened.

"In other words, the fact that the train was being propelled by Diesel engines when the fire occurred is beside the point, because had such a quantity of fuel been permitted to escape under a train running at high speeds in mountain country, would most certainly resulted in a fire that would have materially damaged whatever equipment happened to be in the train make-up.

"Therefore, the essential points are these:

> "1. Had only the regular fueling equipment and system provided for normal operation been in use, the accident could not have occurred.
>
> "2. Even with the special fueling arrangement provided it required five man failures in proper sequence to create the conditions as they occurred.
>
> "3. Diesel engine that was in the fire had not been in operation for some time before the fuel was present to create the fire.
>
> "4. Even if such a quantity of fuel had been discharged on the roof of the train instead of into the cab there is no certainty but that the accident would have been greater, at least to those aboard.
>
> "5. Had the same amount of fuel been discharged on the track and under the train, it is almost certain a major fire would have occurred, no difference what kind of power was pulling the train."



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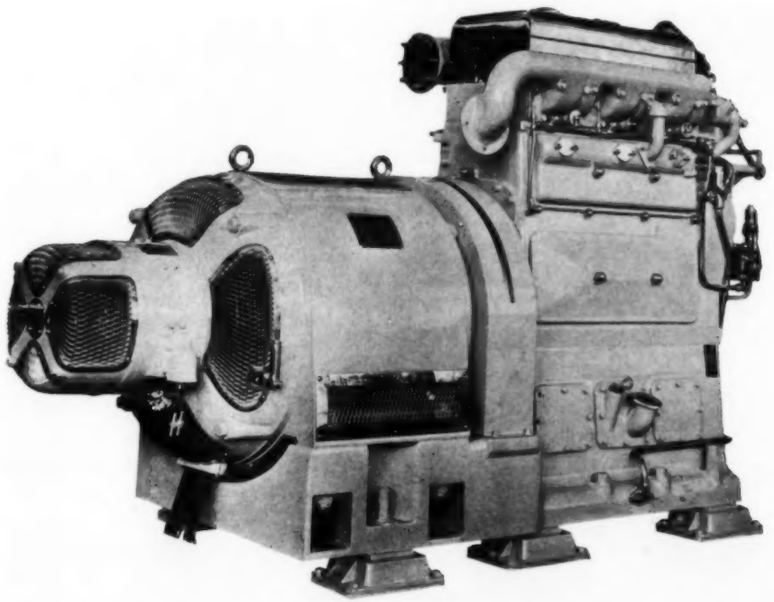

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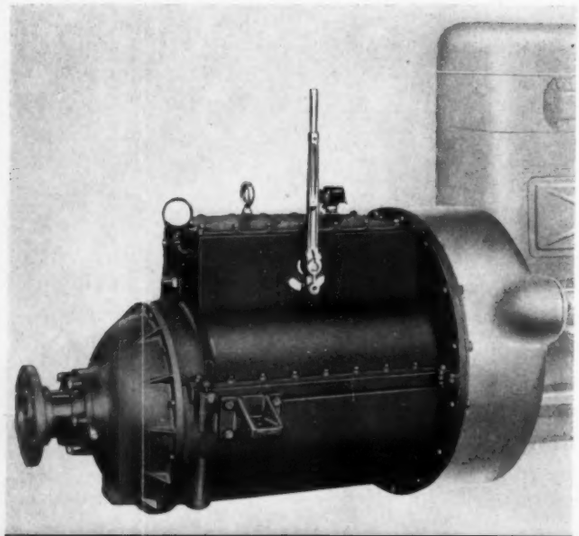

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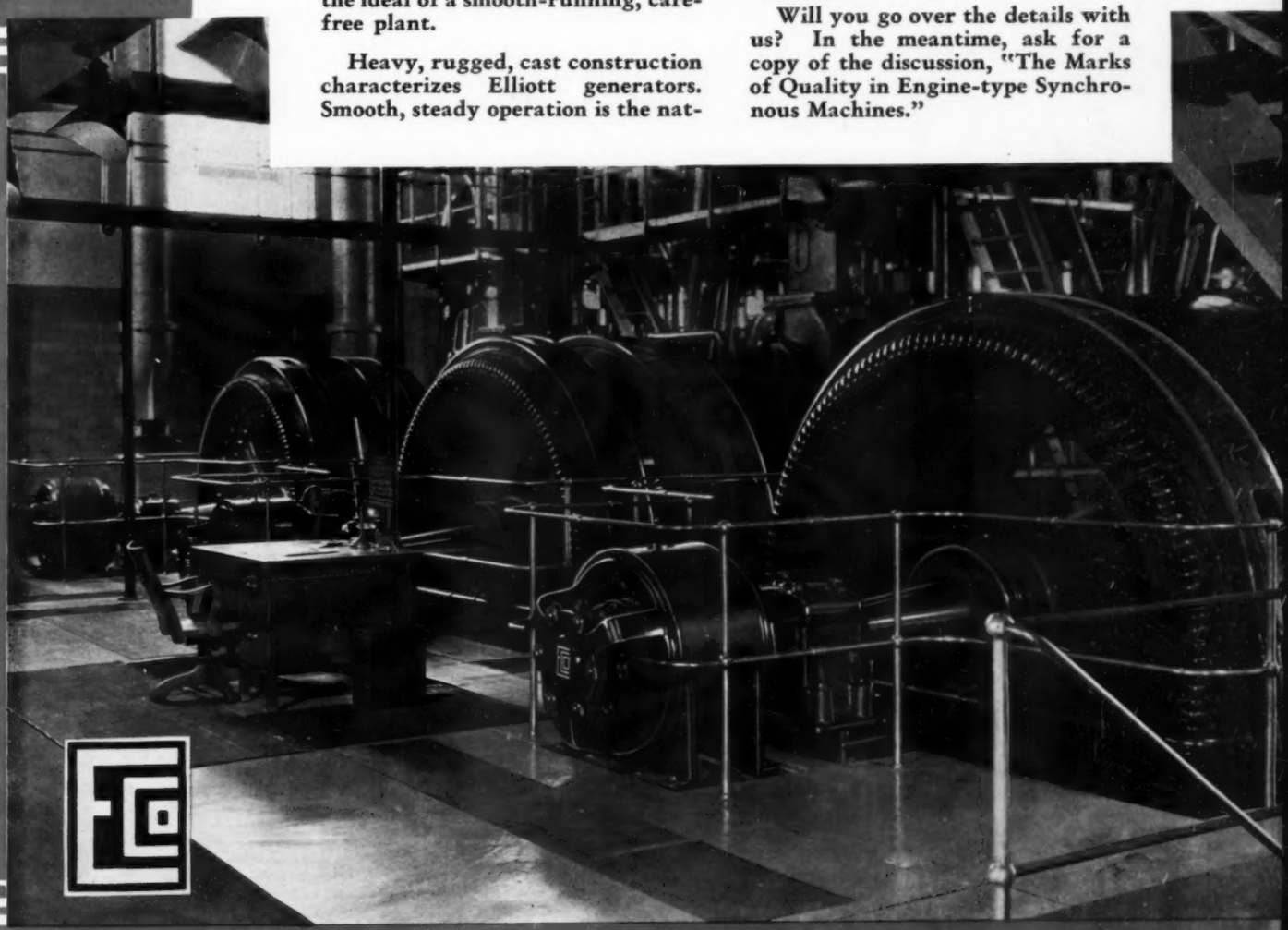

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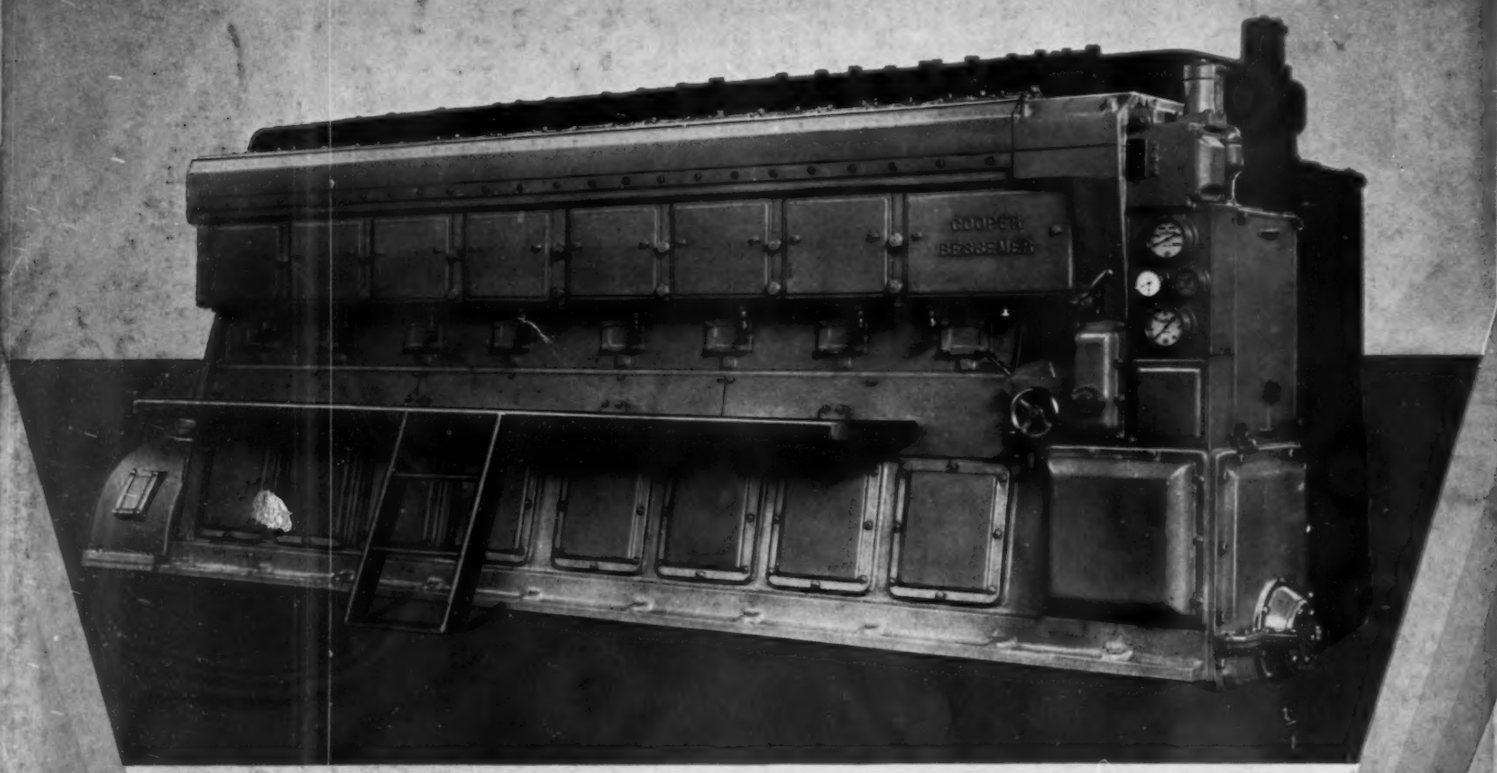

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